January 2001

Catalog, Jefferson College of Graduate Studies, 2001-2003

Jefferson College of Graduate Studies

Policy of Nondiscrimination

Thomas Jefferson University is committed to providing equal educational and employment opportunities for all persons, without regard to race, color, national and ethnic origin, religion, sex, sexual orientation, age, disability or veteran's status.

Thomas Jefferson University complies with all relevant local ordinances and state and federal statutes in the administration of its educational and employment policies and is an Affirmative Action Employer. Any inquiries may be directed to the Manager of Employee Relations or to the University's Affirmative Action Officer at 238 Martin building, (215) 503-7758.

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Provisions of this Catalog

The intent of this catalog is to describe the policies and procedures, program and course offerings, and general information regarding the College of Graduate Studies for the 2001-2003 academic years. It is not intended to be a binding, irrevocable contract between Thomas Jefferson University and the student. The institution reserves the right to alter without notice its policies, procedures, fees, and academic offerings as is deemed expedient and necessary.

Thomas Jefferson University is fully accredited by the Commission of Higher Education of the Middle States Association of Colleges and Schools.

Catalog
College of Graduate Studies
Thomas Jefferson University

2001-2003

College of Graduate Studies
1020 Locust Street
Philadelphia, PA 19107-6799
(215) 503-8986
http://jeffline.tju.edu/CWIS/CGS/

Scientific knowledge provides a foundation for medical education and patient care. It also is responsible for the exciting strides in the prevention and conquest of disease. A focus on basic science training and exploration is essential for the future well-being of medical education, patient care, and the nation's health.

The College of Graduate Studies draws its faculty from basic science departments and the research divisions of clinical departments. Nursing and Health Professions faculty guide the graduate students in those fields.

Thomas Jefferson University has made a large commitment to research and generation of new knowledge. In addition to the present excellent facilities, the University is constructing another major research facility, which will allow us to further increase our research productivity.

Students aspiring to become biomedical scientists have excellent resources available in an environment where academic curiosity and continuous learning are emphasized. The University supports graduate education through a strong fellowship program. Special programs exist for individuals already employed who wish to further their knowledge through part-time study.

To those who wish to join us to learn and to discover in this exciting supportive environment, I extend a welcome and my very best wishes.

Paul C. Brucker, M.D.
President
Thomas Jefferson University

Thomas Jefferson University is a medically oriented university which, through its College of Graduate Studies, offers the Ph.D. degree in nine disciplines related to biology and medicine, and M.S. programs in selected professional fields related to medicine and patient care. The research programs of the University are growing rapidly and offer excellent opportunities for graduate training.

The Graduate Faculty consists of more than 200 members in basic medical sciences and in nursing and health professions. The research laboratories are newly built or recently renovated, and the faculty and their research teams have full access to state-of-the-art equipment. The Bluemle Life Sciences Building houses the laboratories of the departments of Biochemistry and Molecular Biology, Pharmacology, Microbiology and Immunology and Dermatology. Under the Kimmel Cancer Institute and Jefferson Institute of Molecular Medicine, interdisciplinary research enjoys access to many joint facilities. Jefferson Alumni Hall houses the Departments of Pathology, Anatomy and Cell Biology, Physiology, and research laboratories of several clinical departments. The greatly expanded research faculty and facilities offer graduate students exceptional opportunities for thesis research.

Funded training programs in developmental biology and teratology, cardiovascular physiology, cell injury due to alcohol and other substances, genetics, immunology and other fields, further strengthen our educational programs. In addition to fellowship support through foundation grants and University resources, graduate student research is also supported by federal training and research grants. Several program project and center grants broaden the choice of research topics.

Master of Science programs in Biomedical Chemistry, Developmental Biology and Teratology, Microbiology, Nursing, Occupational Therapy, Pharmacology, and Physical Therapy, supported by highly qualified faculty in these fields, prepare students for professional careers in these disciplines.

On the pages of this catalogue you will find detailed descriptions of programs offered by the Graduate College. For additional information or to arrange a visit, please write or telephone the College.

Jussi J. Saukkonen, M.D.
Dean
College of Graduate Studies and
Vice President for Science Policy
Technology Development and International Affairs

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Academic Calendars

The calendar pertains to course scheduling only; beginning and ending dates for each course will fall within dates for each semester. For actual beginning and ending dates for all courses, refer to the **Class Schedule** for each semester which is included in Registration materials.

The University reserves the right to make changes to the academic calendar as circumstances may require.

2001-2002 ACADEMIC CALENDAR
M.S. in Laboratory Sciences, Nursing, Occupational Therapy, and Physical Therapy Students

Fall 2001

Monday, March 25 - Monday, April 15	Registration for Summer/Fall 2001 semester
To be announced	Orientation for New Students 4:00 p.m. (Nursing & Occupational Therapy)
Wednesday, September 5	Fall Semester Classes begin
Monday, November 5 - Monday, November 26	Registration for Spring 2002
Wednesday, November 21	Thanksgiving Holiday begins 5:00 p.m.
Saturday, November 24	Thanksgiving Holiday ends; classes resume
Monday, November 26	Last day to file application for Graduation for this academic year
Friday, December 14	Fall Semester Classes end
Saturday, December 15	Fall Semester Exams begin
Thursday, December 20	Fall Semester Examinations end
Thursday, December 27	**Fall Grades due in Registrar's Office**

Spring 2002

Monday, January 14	Spring Semester Classes begin
Monday, March 4	Spring Recess begins
Monday, March 11	Spring Recess ends
Monday, March 25 - Monday, April 15	Registration for Fall 2002
Saturday, April 27	Spring Semester Classes end
Monday, April 29	Spring Semester exams begin
Saturday, May 4	Spring Semester Exams end
Wednesday, May 8	**Spring Grades due in the Registrar's Office**
Friday, June 7	Commencement Exercises

Summer 2002

Monday, May 20	Summer Semester begins
Monday, May 27	Memorial Day Holiday
Monday, June 24	Summer Session I ends (Nursing)
Friday, June 28	**Summer Session I Grades due in the Registrar's Office**
Thursday, July 4	Fourth of July Holiday
Monday, July 8	Summer Semester II begins
Friday, August 16	Summer Semester ends
Tuesday, August 20	Final Exams end
Thursday, August 22	**Summer Session II Grades due in the Registrar's Office**
Friday, August 30	PT Clinical Affiliations end

2001-2002 ACADEMIC CALENDAR
Ph.D. and Basic Science M.S. Students

Fall 2001

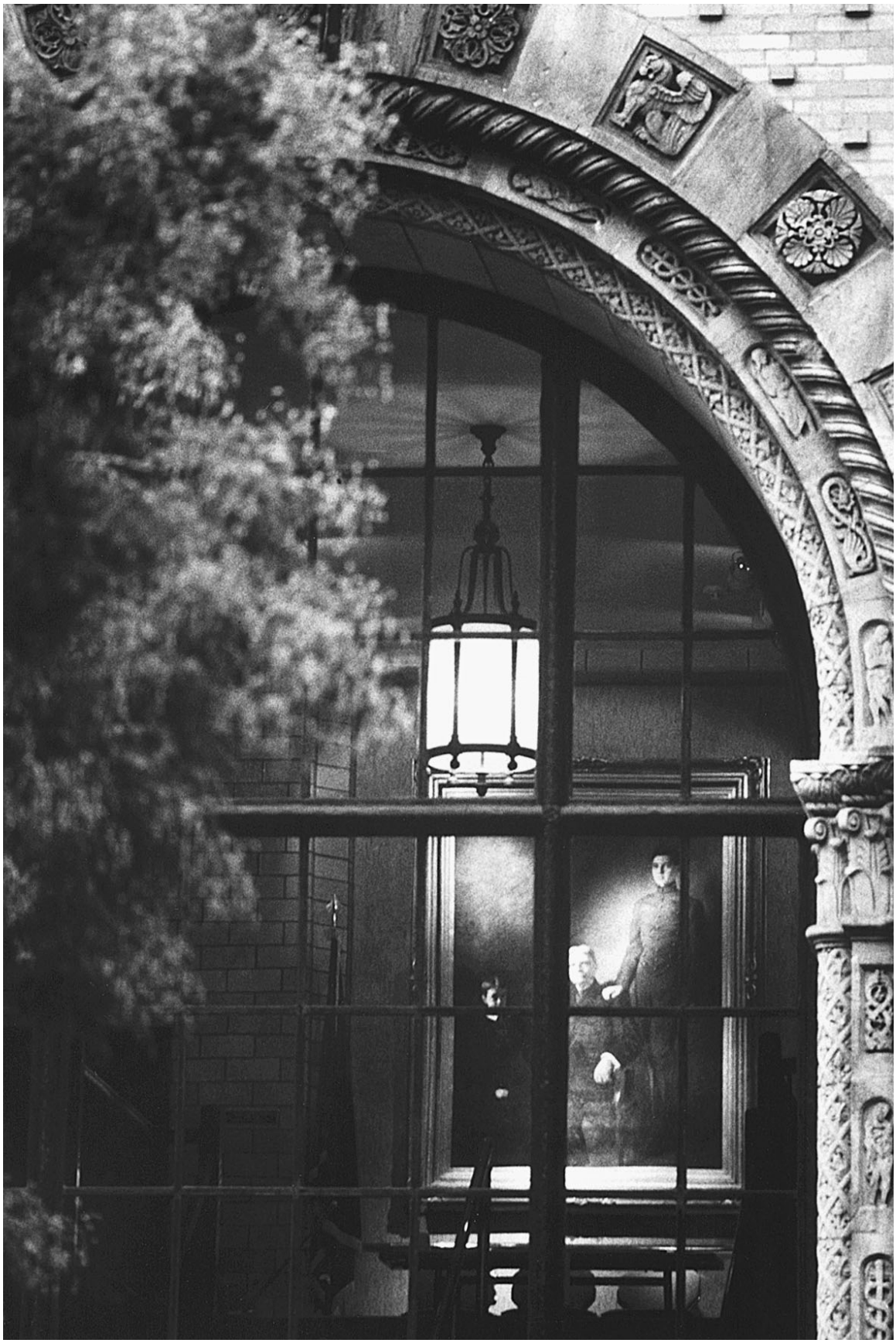
Tuesday, May 29 - Friday, June 29	Registration for Fall 2001 Semester
Friday, August 24	Orientation for New Students 4:00 p.m.-5:00 p.m.
Monday, August 27	Fall Semester Classes begin
Monday, September 3	Labor Day Holiday
Monday, October 8 - Friday, November 9	Registration for Spring 2001
Wednesday, November 21	Thanksgiving Holiday begins 5:00 p.m.
Thursday, November 22	Thanksgiving Holiday
Monday, November 26	Thanksgiving Holiday ends; classes resume 8 a.m.
	Last day to file application for Graduation for this academic year
Friday, November 30	Fall Semester Classes end
Friday, December 7	**Fall Grades due in Registrar's Office**

Spring 2002

Wednesday, January 2	Spring I Classes begin
Friday, March 22	Spring I Classes end
Monday, March 25	Spring II Classes begin
Friday, March 29	**Spring I Grades due in Registrar's Office**
Monday, March 11 - Monday, April 15	Registration for Summer 2002
Tuesday, May 28 - Friday, June 28	Registration for Fall 2002
Wednesday, May 15	**Grades due in Registrar's Office for students who are graduating**
Friday, June 7	Commencement Exercises
Friday, June 14	Spring II Classes end
Friday, June 21	**Spring II Grades due in Registrar's Office**

Summer 2002

Monday, June 3	Summer Semester Classes begin
Thursday, July 4	Fourth of July Holiday
Friday, August 23	Summer Classes end
Friday, August 30	**Grades due in Registrar's Office**



Thomas Jefferson University

Mission

The purposes of Thomas Jefferson University are: to educate qualified students as physicians, nurses, biomedical scientists and allied health personnel; to expand our understanding of human beings and their environment, especially their health and diseases, through research; and to provide and promote health services as a basis for clinical education. To pursue these purposes with balance and distinction, the University fosters a medically, biologically, and health oriented community of scholars, teachers, and clinicians who are so dedicated.

The University

Thomas Jefferson University is an institution of higher learning with a special mission. It is an academic health center consisting of the Jefferson Medical College, the College of Graduate Studies, the College of Health Professions, and its affiliates. At the present time, the total student body exceeds 2,200. The University's educational programs originated with the founding of Jefferson Medical College, the largest private medical college in the country, by Dr. George McClellan in 1824. It was granted a full Charter by the Pennsylvania legislature in 1838.

The College of Graduate Studies

The College of Graduate Studies of Thomas Jefferson University, established July 1, 1969, is responsible for the planning, operation, and administration of educational programs of Thomas Jefferson University that lead to the Master of Science and Doctor of Philosophy degrees. It is also responsible for stimulating, establishing, and coordinating research and post-baccalaureate educational projects that cross traditional school boundaries.

The College of Graduate Studies offers Ph.D. programs in biochemistry and molecular biology, cell and tissue engineering, developmental biology and teratology, genetics, immunology, microbiology and molecular virology, molecular pharmacology and structural biology, pathology and cell biology, and physiology. An M.D./Ph.D. program is offered jointly by the College of Graduate Studies and Jefferson Medical College. The Graduate College also offers M.S. programs in biomedical chemistry, developmental biology and teratology, laboratory sciences, microbiology, nursing, occupational therapy, pharmacology, and physical therapy.

The administrative offices of the College of Graduate Studies are located on the mezzanine floor of Jefferson Alumni Hall, 1020 Locust Street. The Office of the Dean and general administrative offices reside in suite M-63, and the Director of Admissions and Recruitment resides in suite M-46. The Director of Admissions and staff handle all materials of applicants seeking admission to the Graduate College. Enrollment and all academic records of matriculated and non-degree students are administered by the University Registrar and staff, located in the Curtis Building, 1015 Walnut Street. The University Financial Aid Office, located on the ground floor of the College Building, assists students with student loans and other financial matters.

The Graduate Council has jurisdiction over academic policy, acting on behalf of the Graduate Faculty. Its membership consists of representatives of the graduate degree programs. Under the chairmanship of the Dean, the Council approves new programs and courses, and acts on student requests and petitions regarding academic matters.

Each Ph.D. and M.S. degree program is supervised by a faculty committee, headed by a program director. Some programs have divided the duties among several directors.

Jefferson Alumni Hall spans the block between 10th and 11th Streets on Locust Street and holds many of the basic science departments and research laboratories. It also houses a sports facility with the latest exercise equipment, a full-sized pool, and basketball and handball courts. Dining facilities surrounded by garden courts, student lounges, and study areas are located on the ground level.

The Bluemle Life Sciences Building, opened in July 1991, provides over 150,000 square feet of laboratory space and state-of-the-art equipment and facilities. Its principal occupants include the laboratories of the departments of Biochemistry and Molecular Pharmacology, and Microbiology and Immunology.

Jefferson Medical College

Founded in 1824, Jefferson Medical College provides students with learning opportunities which will enable them to acquire basic knowledge and skills in the biomedical sciences as well as to develop appropriate professional behaviors. The curriculum also allows students to pursue some of their special interests throughout their medical training.

The primary goals of the curriculum at Jefferson Medical College are (1) to provide each student with a core curriculum that contains the *sine qua non* that should pertain to all physicians; (2) to provide each student with advanced curriculum opportunities in order to prepare himself/herself in depth in one of the areas of basic or clinical medical sciences; and (3) to enable the future physician to develop a humanistic as well as a scientific approach toward the care of people with medical problems.

Students benefit from a superior basic science faculty, supportive alumni, and a network of affiliated hospitals that provide a wealth of clinical experiences. The College conducts a highly regarded longitudinal study, which ensures the applicability of the curriculum to future professional experiences.

In addition to the four-year curriculum, there are a number of programs that provide a variety of special opportunities.

A combined M.D./Ph.D. program is jointly offered by the Jefferson Medical College and the College of Graduate Studies for students who wish to prepare for a career in academic medicine or medical research. This program is described elsewhere in this catalog. In recognition of the vast economic and political forces that influence the quality of healthcare, the medical college offers a combined M.D./M.B.A. five-year program. The program is jointly offered with Widener University and prepares graduates for leadership roles in the healthcare industry. The Physician Area Shortage Program recruits and educates

medical students who intend to enter family medicine and practice in an underserved area of the state. The Delaware Institute for Medical Education and Research (DIMER) is a joint medical education program with the University of Delaware and the Medical Center of Delaware. Jefferson Medical College and Penn State University offer a joint six-year program for highly qualified students. Graduates receive B.S. and M.D. degrees. The College's Pre-Health programs, offered jointly with Bryn Mawr College and the University of Pennsylvania, attract highly qualified applicants who have chosen to change careers and require post baccalaureate courses before entering medical school.

For more information, please contact: Jefferson Medical College, the Office of Admissions, 116 College Building, 1025 Walnut Street, Philadelphia, PA 19107-5083, or call (215) 955-5462.

The College of Health Professions

The College of Health Professions of Thomas Jefferson University was established July 1, 1969. Hospital programs in the nursing and allied health professions, which began in 1891, were integrated into a School of Allied Health Sciences in 1967 and into the College of Allied Health Sciences in 1969. In 1997, The College officially changed its name to the College of Health Professions to better reflect changes in the health care system and recognize the close working relationship between nursing and allied health professionals.

The College of Health Professions was established to provide an academic division for undergraduate education of students in the health related professions. It was the first provision for undergraduate college education at Jefferson under its charter of 1838 granting full university rights and privileges. Curricula lead to associate of arts, associate of science, and baccalaureate degrees in nursing and the allied health sciences. Through the College of Graduate Studies, Master's degrees in laboratory sciences, nursing, occupational therapy, and physical therapy are offered.

In addition to the curriculum in medicine, training for related health fields has been part of the Jefferson tradition for many years. Most of these training programs arose in response to the physician's requirement for patient-side assistance and have evolved from courses provided to trainees who rendered service within departments of the hospital. These programs form the nucleus of the professional units of the College of Health Professions. Programs offered at the baccalaureate level include Diagnostic Imaging, Laboratory Sciences (Biotechnology, Cytotechnology, Cytogenetic Technology and Medical Technology), Nursing, Occupational Therapy, and Physical Therapy. These programs are upper division undergraduate programs, requiring two or three years of successful study at another college or university. Physical Therapy students matriculate in the College of Graduate Studies after two years of successful undergraduate study in the College of Health Professions. A new program in occupational therapy allows students who have earned a bachelor's degree in a field other than occupational therapy to receive a certificate of proficiency and a Master's degree in occupational therapy.

Student Services

Minority Affairs

The Graduate College works in conjunction with University organizations and departments to coordinate cultural diversity activities throughout the University. Through collaborative efforts of administrative representatives from the three colleges, the University Multicultural Committee was formed. This “all college” council consists of organizational representatives from all university student organizations. This committee monitors, promotes and supports multicultural activities sponsored by individual organizations, and hosts an annual university-wide “International Festival.”

The Jefferson African American Student Society (JAASS), a rapidly growing student organization, provides a network and support system for African American students matriculating in the three colleges. JAASS student members actively participate in university sponsored minority recruitment initiatives. They contribute to university retention efforts by coordinating peer mentoring and tutoring services for minority students enrolled in programs of study in all academic divisions. Fellowship activities include: New Student Reception, KWANZA celebration, Black History Month, cultural and professional enrichment activities, and congratulatory program for graduating members. Service projects include: Walk for Diabetes, neighborhood improvement projects, mentoring of minority high-school students, coordinating and hosting TJU campus visits for minority students from area high schools, etc. Members of this organization meet monthly to conduct business and to plan activities.

Graduate Student Association

The Graduate Student Association was formed within the College of Graduate Studies in 1969 to promote interaction among students, faculty, and administration within the Jefferson community. Today, emphasis is placed on enhancing the quality of student life, both inside and outside of the educational setting. The officers of the GSA also assist faculty and administration in the dissemination of information among the student population.

GSA-sponsored events offer students, faculty, and administration the opportunity to interact in a relaxed environment. The GSA holds monthly open meetings as a forum for student opinions and ideas that are relevant to student life. In addition, the group organizes social events, as well as educational events. The GSA has recently started the “Presentations and Conversations in Research” (PCR) series, during which graduate students present their research to other students.

The GSA also serves the Philadelphia community through a variety of innovative programs and events. Recent events include the Diabetes Walk, Breast Cancer Walk, and International Day. All matriculated students of the College of Graduate Studies are members of the GSA and are encouraged to participate actively in the organization which represents them. If you would like to know more about the Graduate Student Association or how you can get involved, please visit our web site at www.geocities.com/jeffgsa.

College of Graduate Studies Alumni Association

All graduates of the College of Graduate Studies are recognized as members of the Alumni Association. Membership offers certain privileges, such as the use of the Scott Memorial Library, the ability to purchase a Jefferson Commons membership, discounts at Jefferson's pharmacies and dining facilities, and a discount available at the Jefferson Parking Garage with advance purchase of special discount coupons. All alumni are issued Alumni Identification Cards at the time of graduation at no charge.

The Association's purpose is to encourage a continuing relationship between the alumni and the Graduate College and its students. The Association also assists the College in furthering its goals of improved educational and research activities for students and alumni through meetings and other forms of communication.

Alumni are invited to return to campus for the annual Alumni Day in the spring, alumni meetings, and special events. Alumni are also encouraged to participate in fund-raising efforts in support of student programs, travel and other fellowship funding, and a research prize.

Activities Office and Commons Recreation Facility

The Thomas Jefferson University Activities Office coordinates social, cultural, and recreational programs for the entire Jefferson community. Students are encouraged to participate in many events occurring regularly throughout the year, including movie nights, entertainment programs, co-curricular programs and workshops, and showcase performances. The Activities Office also offers a variety of ticket sales to professional sporting events, amusement parks, museums, performing arts and cultural attractions. The Activities Office is located in Room B-100 Jefferson Alumni Hall.

The Activities Office is responsible for managing the Commons, Jefferson's multipurpose recreation and fitness facility and its many programs and services. Located in the lower levels of Jefferson Alumni Hall, the Commons facility offers members the use of a swimming pool, gymnasium, racquetball court, cardio and weight rooms, group exercise studio, dry heat sauna and men's and women's locker rooms.

The Commons offers many recreational programs and services including group exercise classes, fitness testing and exercise prescriptions, personal fitness training, massage therapy, intramural sports (competitive and mixed volleyball, basketball, softball, racquetball and squash), and co-curricular courses such as ballroom and swing dance lessons, SCUBA certification, swim lessons, and golf instruction.

Membership to the Commons is available to all students, employees, house staff/postdoctoral fellows, and alumni of Thomas Jefferson University, Thomas Jefferson University Hospitals, Jefferson Health System, and Wills Eye Hospital. The membership fee for all full-time Jefferson students is included in the Comprehensive Student Fee paid at registration. Full-time students must complete a mandatory facility orientation and obtain an I.D. card validation in order to gain access to the Commons facility. All others must register for Commons membership in the Activities Office.

The *University Activities Guide* is published annually by the Commons Board and is distributed through the Activities Office. This publication includes descriptions of more than 70 campus organizations and groups.

Housing

The University Housing Office administers on-campus housing facilities and distributes information regarding off-campus housing. The University Housing Office maintains housing assignment lists, assigns apartments and rooms, notifies students of housing assignments and collects deposits and rent.

In order to minimize the time spent finding accommodations in the Philadelphia area, you are encouraged to use the services of the University Housing Office:

Department of Housing and Residence Life
Thomas Jefferson University
1000 Walnut Street, Suite 103
Philadelphia, PA 19107-5518

Telephone: (215) 955-8913

Website: http://jeffline.tju.edu/CWIS/University_Services/housing/

On-Campus Housing

The on-campus residential facilities are conveniently located within walking distance of Philadelphia's shopping, cultural, and recreational activities.

Application. An on-campus housing assignment is guaranteed to eligible first-year students, who will be enrolled full-time. Contact the Housing Office for details. Interested parties are invited to apply for an apartment or residence hall space prior to acceptance to the College. Applications may be obtained by writing or telephoning the Housing Office.

Orlowitz Building. The Orlowitz Building is a 20-story apartment facility on the southwest corner of Tenth and Walnut Streets, directly across the street from Jefferson Medical College and near Jefferson Alumni Hall. This modern facility has 237 apartments of which 171 have one bedroom (a number of which are furnished), 56 have two bedrooms, and 10 have three bedrooms.

Barringer Building. The Barringer Building, opened for occupancy in 1976, is a ten-story apartment facility on the southeast corner of Tenth and Walnut Streets. This facility has 138 apartments, of which 12 are efficiency apartments, 54 have one bedroom, 63 have two bedrooms, and 9 have three bedrooms.

Each Barringer and Orlowitz apartment has wall-to-wall carpeting, air conditioning, kitchen appliances, and cable TV hook-up availability. All utilities are included in rental rates, except telephone and cable TV service, which can be installed by individual arrangement. Storage lockers, a vending area, and laundry facilities are located in each basement. A social lounge with a large screen cable TV is available for tenant use. The Orlowitz lounge has an adjoining kitchen and outdoor courtyard. Both buildings offer 24-hour desk and emergency maintenance coverage.

Martin Building. The Martin Building is an eight-story office and residential building located at 201 South 11th Street. It is adjacent to the Scott Memorial Library and across the street from the Foerderer Pavilion of Thomas Jefferson University Hospital. The building has furnished rooms and can accommodate approximately 140 students.

Depending on occupancy needs, the building may accommodate both co-ed and single sex floors in double or single occupancy rooms. Each furnished, air conditioned room is equipped with a Microfridge (microwave/refrigerator/freezer). Common bath and shower accommodations are available on each floor. Each floor has a snack kitchen for limited food preparation that contains a refrigerator, a freezer, and a microwave.

The Martin Building provides a sun deck, study room, recreation lounge with a large screen cable TV, and vending areas. Like Barringer and Orlowitz, Martin has 24-hour desk coverage and emergency maintenance service.

Residence Life Program. The Residence Life program is available in all three residential facilities. The staff consists of one full-time, live-in professional and 10 student Resident Assistant advisors. The staff provides social, educational, and recreational programming, support services, and function as a liaison between students and housing management.

Off-Campus Housing Services

The Housing Office provides an off-campus information service. You should begin your search for off-campus housing in June. This will provide you with enough time to identify the various accommodations available.

If you will be visiting Philadelphia, check the Off-Campus Bulletin Board located in the first floor lobby of the Edison Building, 130 South 9th Street, for the most current information.

The Housing Office also maintains a listing of local realtors and apartment facilities.

Academic Information Services and Research

Academic Information Services and Research (AISR) provides a full range of services in support of the information needs of the University in the areas of research, education, and clinical care. Its departments include the Scott Memorial Library, Academic Computing, and Medical Media Services. Its services include on-line access computer labs, library services, and on-line information services.

The Scott Memorial Library collection reflects the University's interests in the life sciences, clinical medicine, patient education, and the history of the health sciences. A thorough reference collection includes a wide variety of information resources in electronic format. A collection of leisure reading materials is available. Also, via interlibrary loan, provided at no cost, Jefferson students can obtain materials from other libraries. The Library is staffed some 100 hours per week; however, users have twenty-four hour access to the first and fourth floors.

JEFFLINE, the online information system of AISR, provides a wide variety of electronic resources, including specialized databases, over 600 electronic journals, and numerous electronic books. The JEFFLINE system also organizes the Web sites for educational courses, including distance education software. The Library's Learning Resources Center provides access to videos, models, and other non-print materials and two electronic classrooms. Overall, AISR provides more than 120 publicly-accessible computers.

AISR's staff of professional instructional designers, artists, educators, animators and computer programmers consult with faculty on the design and development of new educational software. An extensive offering of workshops, seminars, and graduate courses in the area of information management is available for students.

University Bookstore

The Thomas Jefferson University Bookstore, located at 224 South 11th Street, provides a convenient and economical source for all textbooks and academic supply requirements, including medical supplies and software. Also available is an excellent selection of personal, recreational, and gift items displaying the Jefferson insignia.

The bookstore maintains regularly scheduled hours: Monday to Friday from 8:30 a.m. to 5:00 p.m. and Saturday from 9:00 a.m. to 1:00 p.m. Also, during the fall and winter rush period, the bookstore extends its weekly hours to provide students ample opportunity to purchase textbooks. For more information, call (215) 955-7922, fax (215) 923-1844, or visit the web site www.tju.bookstore.org.

University Medical Editing Office

The University Medical Editing Office provides writing and editing help, free of charge, to faculty, staff, and students of the College of Graduate Studies, Jefferson Medical College, and the College of Health Professions, Thomas Jefferson University Hospital and affiliated institutions. Advice or assistance in the planning and writing of professional papers, case reports, review articles, research protocols, and grant applications is available upon request. Office hours are 10:30 a.m. to 5:30 p.m., Monday through Friday. The Medical Editing Office is located at 1710 Edison Building and may be contacted at (215) 503-4042. The University Medical Editor is John J. Gartland, M.D.

University Health Services - Student Health

The University Health Services (UHS), in Suite 6230 Gibbon Building, 111 South 11th Street, is open to students from 8:00 a.m. until 4:00 p.m. Mon.-Fri. The telephone number is (215) 955-6835.

Students may come in to see the physician, the nurse, or get immunizations from 8:00 a.m. until 4:00 p.m. Mon.-Fri. No appointment is necessary.

During evenings and weekends, students should report to the nearest Emergency Room (ER) if an urgent medical problem arises. The ER of Thomas Jefferson University Hospital is located on 10th Street between Walnut and Sansom Streets. The ER telephone number is (215) 955-6840.

UHS offers medical care (from board-certified internal medicine physicians), referrals for specialty care, immunization updates, occupational exposure care, TB screenings and flu shots.

There is no charge to see the doctors in UHS. However, there may be a charge for some immunizations, referrals, diagnostic tests and x-rays, and any treatment in the ER. The student will be responsible for anything not covered by his/her health insurance.

Upon admission to the College of Graduate Studies, all students in degree programs are required to provide to University Health Services a pre-matriculation report of medical history, health evaluation, and proof of inoculation. Appropriate forms are sent to all new students prior to the Fall Semester or prior to matriculation at any other time. The physical examination may be given either by the student's private physician, or at University Health Services at the student's expense.

A student must take care of this matter at time of matriculation; if he/she fails to comply with this regulation, the student will not be allowed to register for the following semester.

Please see section on "Health Insurance for Graduate Students" in this catalog regarding the requirement for health insurance coverage.

Health Insurance for Graduate Students

Thomas Jefferson University requires that all students have adequate and acceptable health insurance. The University offers a group health insurance policy to all registered graduate students. If the student chooses not to purchase the University's student health insurance policy, the student must request a waiver and provide proof of comparable coverage acceptable to the University. Students should note that, if they choose not to use the services of the Jefferson Health System, they need to make sure that their specific health policy is accepted. Students are also able to purchase coverage for a spouse or dependents. Information about this student health insurance policy is provided to all students before each academic year begins. Specific questions should be directed to the Finance Office of the Graduate College in M-63 Jefferson Alumni Hall, (215) 503-8986.

International students must purchase the graduate/medical student policy in keeping with Federal INS regulations and University responsibilities. All international students must show adequate health care coverage for their dependents. For international students, there may be additional insurance requirements. Please check with the Office of International Exchange Services, (215) 503-4335.

Office of International Exchange Services (OIES)

The University sets a high priority on the exchange of ideas related to research, patient care, and education with members of the international community. We welcome people from other countries to work, study, and engage in research here and encourage Jeffersonians to study, lecture, and do research abroad.

In 1991, the University created the Office of International Exchange Services, directed by Ms. Janice Bogen. The office reports to Dr. Jussi J. Saukkonen, Dean of the College of Graduate Studies and Vice-President for Science Policy, Technology Development and International Affairs.

The office works closely with all University divisions and departments to handle the immigration requirements and the orientation of our visitors. The four primary functions of OIES are: to help departments that want to bring international students, scientists, and physicians to Jefferson, to be the central resource for international visitors, to provide support for the University's international initiatives, and to assist Jeffersonians going abroad for professional and educational purposes. The office helps students with acculturation by supplying practical information that makes their daily living easier. The International Office has information on the process of settling in, local public transportation, car rental, housing, tax responsibilities, and cultural and historic sites. The office handles all paperwork involving procurement and maintenance of visa status. Many resources for students who wish to study abroad are available in the International Office.

The Office of International Exchange Services is located in M-70 of Jefferson Alumni Hall, (215) 503-4335/4024/4023.

Commuter Services Office

The Commuter Services Office (CSO) is located at 924 Walnut Street. The hours of operation are Mondays through Fridays from 7:00 a.m. until 5:30 p.m. The office is closed on weekends and all University holidays.

CSO encourages all Jeffersonians to use local mass transit where available. Using these public services reduces gas consumption and helps save our environment. CSO services include discounted mass transit items:

SEPTA	Tokens - 5 & 10 Packs, Trail/Transpasses 10-Trip Regional Rail Lines tickets and Day Passes and Monthly Pass Program
PATCO	2 and 10 day trip tickets

CAMPUS AREA PARKING Restricted daily and *limited* monthly parking is available at the following locations. Contact CSO about availability of monthly parking.

Parkway Corp. Parking - 12th & Sansom Streets
Walnut Towers - 9th & Walnut Streets
Girard Square - 1120 Clover Street
Central Parking System Garages - 12th & Sansom Streets,
10th & South Streets, 1111 Sansom Street,
and 10th & Ludlow Streets

Information on additional parking lots and conditions for discounted parking is available in CSO.

The CSO web site is http://cso.tju.edu

Food Services

Food service and catering on campus are managed by the Department of Nutrition and Dietetics of the Thomas Jefferson University Hospital. The Atrium cafeteria, located on the second floor of the Gibbon building is a full-scale cafeteria. The hours of operation are 6:45 a.m. to 7:30 p.m. on weekdays and 6:45 a.m. to 7:00 p.m. on weekends and University holidays. The steam table and grill areas are not open from 2:30 p.m. to 4:30 p.m.

The Jefferson Alumni Hall Food Court is open to the Jefferson community for breakfast, lunch, and snacks Monday through Friday from 7:30 a.m. to 1:30 p.m. Satellite food service operations are also located in the lobbies of the Pavilion building and The Hospital for Neurosciences. These carts are open for breakfast and lunch.

Call 5-FOOD for daily specials in the Atrium and at the satellite carts.

Services provided by the catering department range from simple Continental breakfasts or soda breaks to working lunches, dinners, and elaborate banquets. Groups or individuals are not permitted to bring their own food or hire a private caterer for any event. Rooms must be reserved through the Reservations Coordinator in the Department of Nutrition and Dietetics prior to menu planning. Events should be scheduled two weeks in advance. The minimum attendance guarantee or event cancellation needs to be provided at least 2 business days prior to the event.

University On-Campus Facilities

The University's campus occupies approximately 13 acres on four city blocks in the heart of Center City Philadelphia. It is bounded by Chestnut and Irving Streets to the north and south, and 9th and 11th Streets to the east and west. The campus comprises 16 major buildings with approximately 3,400,000 gross square feet of space. In addition, the University leases approximately 55,000 gross square feet of additional space in buildings or portions of buildings located near the campus. This leased space houses physician offices, a home health care program, the University bookstore, and certain University administrative offices.

The Jefferson campus is surrounded by historic and cultural attractions. Three blocks east lies the most historic square mile in America: Independence National Historic Park. Excellent intercity transit offers easy access to shopping, theaters, museums, sporting events, and the new Pennsylvania Convention Center. Night life and recreational facilities are in abundance throughout Philadelphia and the Delaware Valley. The Poconos, New York City, the New Jersey shore, and Washington, D.C. are within easy reach by car or train.

Thomas Jefferson University Hospital

The Thomas Jefferson University Hospital is housed in a four-building complex comprised of the Foerderer Pavilion, the Main Building, the Thompson Building, and the Gibbon Building, where emergency, in-patient and out-patient ancillary facilities and offices are centered. Private physicians' offices are also located in the Gibbon Building.

Bodine Center for Cancer Treatment occupies 56,000 sq. ft. It was constructed underneath a portion of the New Hospital and was completed in 1987.

Foerderer Pavilion occupies 236,000 sq. ft. on 17 floors. The facility was completed in 1954 and contains 180 licensed beds and ancillary facilities. The second through seventeenth floors have been renovated within the past eight years. The first floor, newly renovated, serves as an out-patient facility.

Gibbon Building occupies 772,000 sq. ft. on 10 floors. It was completed in 1978. Gibbon contains 403 licensed beds, office space for approximately 100 physicians, and 17 clinical departments, ancillary and support services, and commercial space.

Main Building occupies 176,000 sq. ft. on 12 floors. Completed in 1907, the building now contains the emergency and trauma care center, professional, diagnostic, therapeutic, and support facilities.

Thompson Building, completed in 1928, occupies 172,000 sq. ft. on 20 floors. Significant portions have been renovated within the past 10 years and now contains 124 licensed beds.

Jefferson Alumni Hall

Jefferson Alumni Hall, completed in 1968, is the basic medical science/student commons building, which houses the administrative offices of the College of Graduate Studies, the Jefferson Medical College Office of Student Affairs, basic science departments, classrooms, research laboratories, the Faculty Club, and a central animal facility. In addition, the lower three levels, known as “Jefferson Commons,” include the Activities Office and Commons Recreational facility.

Bluemle Life Sciences Building

The 11-story research building at 10th and Locust Streets opened in July 1991. It provides over 150,000 square feet of laboratory space and state-of-the-art equipment and facilities. The facility houses the laboratories of Biochemistry and Molecular Pharmacology, and Microbiology and Immunology.

Samuel Parsons Scott Memorial Library and Administration Building

Completed in 1970, the Scott Building houses University administrative offices and the University Library. The Scott Memorial Library occupies the second, third and fourth floors of the Scott Building. The collection now numbers some 170,000 books and bound journals and over 2,200 current periodical subscriptions. Its features include individual and group-study rooms, soundproof rooms for typing or audiovisual use, audio-visual equipment, a browsing room for recreation reading, coin-operated photocopy equipment, conference and seminar rooms, and the P. Brooke Bland Rare Book Room. A unique feature is the Basic Reading Room on the street level where the latest texts, reference books and important journals are available on a 24-hour, seven-day per week basis.

Edison Building

The Edison Building contains administrative offices and classrooms for academic programs of the College of Health Professions. It also houses commercial office space, private physicians offices, and University corporate offices.

Jefferson Medical College Building

The Jefferson Medical College Building, connected to the Curtis Building, was completed in 1931. It contains laboratories, classrooms, and offices for the clinical faculty of Jefferson Medical College and the Medical College administration.

Curtis Building

The Curtis Building, connected to the Jefferson Medical College Building, was completed in 1931. It contains laboratories, classrooms, and offices for the clinical faculty of Jefferson Medical College and the Medical College administration.

Medical Office Building

The Medical Office Building is an eight-story office facility located on the southwest corner of 11th and Walnut Streets. The building contains a Surgi-Center on the second floor, a Medical Genetics Center on the fourth floor, a Breast Imaging Center on the ground floor and physician offices on the other floors.

Out-Patient Facilities

Jefferson leases many medical office suites in nearby buildings, including Walnut Towers, the Ben Franklin House, 909 Walnut, and 1015 Chestnut Street. These facilities comprise a network of outpatient offices for many medical specialties.

Residence Halls

Please refer to the section on Housing in this Catalog.


Cytokine Receptors in Action
Syringe
Kimmel
Cancer
Institute
Immunology

College of Graduate Studies

General Information on Academic Programs

Graduate programs leading to the degrees of Doctor of Philosophy and Master of Science are administered by the College of Graduate Studies. The programs are designed primarily for those whose aim is either the Doctor of Philosophy degree in biochemistry and molecular biology, cell and tissue engineering, developmental biology and teratology, genetics, immunology, microbiology and molecular virology, molecular pharmacology and structural biology, pathology and cell biology, or physiology; or the Master of Science degree in biomedical chemistry, developmental biology and teratology, laboratory sciences, microbiology, nursing, occupational therapy, pharmacology, or physical therapy.

Programs of graduate study may be undertaken in interdisciplinary areas by special arrangement. Such programs are cooperative efforts of two or more graduate programs and are arranged following approval of the programs concerned and of the Graduate Council; the student is officially registered in the graduate program in which there is the greatest relative interest and emphasis.

A program leading to combined M.D./Ph.D. degrees is also available through Jefferson Medical College and the College of Graduate Studies. This program, jointly administered, is described in a later section of this catalog.

A student who is pursuing the Ph.D. degree in the College of Graduate Studies must complete requirements for that degree before being considered for admission to another degree program at Thomas Jefferson University.

The Phases of Graduate Study

Doctor of Philosophy Programs

Typically, doctoral programs consist of: 1) graduate level course work; 2) comprehensive ("preliminary") written and oral examinations leading to candidacy for the degree; 3) thesis research; and 4) defense of the thesis. Training in the intellectual and technical skills which will permit the graduating student to continue on towards an independent research career begins in the first year with a series of short stays in the laboratories of program faculty. This provides the student with exposure to a variety of scientific interests and experimental methods, following which the student selects a research advisor in whose laboratory the thesis research will be conducted. This phase is usually completed within the first year and a half of study. Following a series of graduate courses addressing the fundamentals of a discipline, the student enrolls in advanced graduate courses and seminars. The comprehensive examination is taken after all required course work has been completed, usually by the end of the second year. The total time required to complete a Ph.D. program depends to a large measure on the student's rate of progress in research. In most instances, Ph.D. candidates have been able to complete their studies within four to five years from the time of matriculation.

M.D./Ph.D. Program

The M.D. / Ph.D. program is for students who wish to prepare for a career in academic medicine and medical research. This program requires study in both Jefferson Medical College and the College of Graduate Studies and provides

students with medical education and a theoretical and practical foundation in a field of biomedical research. Students enrolled in the combined degree program will receive credit in the Graduate College for basic science courses taken in the Jefferson Medical College. Refer to the section on the Combined M.D./Ph.D. Program in the Ph.D. section and also the Admissions section for further information.

Master of Science Programs in the Basic Sciences

Building on the bachelor's degree, the Master of Science programs in 1) Biomedical Chemistry, 2) Developmental Biology and Teratology, 3) Microbiology, and 4) Pharmacology prepare researchers as well as practitioners and professionals. The programs provide a stepping stone to the doctoral and professional degrees as well as a capstone for a professional career. Graduates have been accepted into doctoral, medical, dental, veterinary and law programs. The College of Graduate Studies provides advanced training in science, and skills needed for success in the rapidly changing environments of biotechnology, pharmaceutical industry, and healthcare. The programs were designed to be part-time programs with classes scheduled for late afternoon or early evening, enabling students to be employed full-time, and therefore able to take advantage of educational benefits provided by their employers. Discounted parking is available near campus for these late classes.

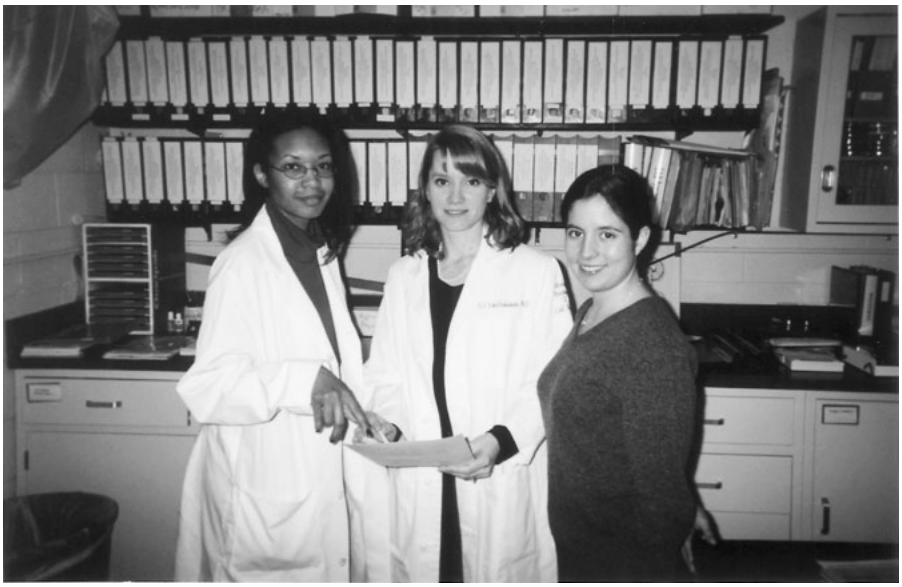
Master of Science Programs in the Health Professions

The Master of Science programs in 1) Laboratory Sciences, 2) Nursing, 3) Occupational Therapy, and 4) Physical Therapy prepare the graduates for supervisory or other professional positions in fields of importance in the delivery of health care. The Nursing program and the Occupational Therapy program, for students with a B.S. in OT are designed to accommodate the needs of part-time students. The M.S. program in Occupational Therapy for students with a B.S. in a field other than OT, the combined B.S./M.S. programs in Physical Therapy, and the Nursing Accelerated Pathway from B.S.N. to M.S.N. are offered only on a full-time basis.

Graduate Certificate Programs

The College of Graduate Studies at Thomas Jefferson University and its Graduate Center for Education and Training offers training initiatives designed to provide industry, academic and health professionals with the contemporary skills and knowledge needed to be successful in today's changing pharmaceutical and biotechnology environment. Health related industries are projected to continue their steady growth for years to come. There is considerable demand for qualified professionals. In response, the College of Graduate Studies, a leader in planning and implementing high quality graduate programs, has developed master's and certificate programs offered at times convenient to practicing professionals and focused on growth areas in the industries. The Certificate Programs are: 1) Clinical Research, 2) Research Administration and 3) Public Health.

The aims of the certificate programs are to improve technical and managerial skills for career advancement or to gain knowledge and skills for increased career options without interrupting employment. The certificate programs (equivalent to 15 credit hours of graduate education) are offered through late afternoon and evening courses on campus and through video-conferencing to job sites. Graduate courses available in these programs include: pharmacoeconomics, epidemiology, statistical methods, biotechnology venture management, grant management, clinical trials management, scientific writing, financial management, drug development issues, experimental design in research, presentation skills and biosafety.



General Admissions Requirements

The successful applicant must have received a bachelor's degree from an accredited college or university prior to matriculation in the College of Graduate Studies. Students who hold a master's degree in an appropriate discipline, or a doctoral degree in medicine, veterinary medicine, or dentistry are also eligible. A strong background in the sciences and excellent English language skills are considered essential to success in the graduate programs. Applicants are required to take the Graduate Record Examination (GRE) General Test, demonstrating an appropriate level of accomplishment. The GRE or the Medical College Admissions Test (MCAT) is acceptable for the M.S. programs in the basic sciences. For the M.S. programs in nursing, occupational therapy, and laboratory sciences, the Miller Analogies Test (MAT) may substitute for the GRE. GRE subject tests in disciplines related to the student's program interest provide enhancement to application but are not required for admission. Please refer to the program section in this Catalog for additional information regarding GRE requirements.

The results of the GRE, while important, are considered in conjunction with other applicant credentials. No minimum acceptable score has been established by the Graduate College; however, in recent years, the matriculating class has had an average of 1100 or higher in the combined verbal and quantitative scores of the GRE, and a college GPA well above 3.0. It is the policy of the College of Graduate Studies only to accept scores from the Graduate Record Examination taken during the five years preceding the expected time of matriculation at Jefferson. The Educational Testing Service (ETS) should be directed to submit GRE scores to the Director of Admissions. The Thomas Jefferson University code is 2999-1.

The Test of English as a Foreign Language (TOEFL) is required for students whose first language is not English. (This requirement does not apply to students whose bachelor degree was earned at an accredited U.S. college or university.) (International applicants may be required to have academic transcripts evaluated by a professional transcript evaluation service.)

In addition to the general requirements of the College of Graduate Studies, individual degree programs may have additional requirements which are described in program and curricular sections of this catalog.

For specific requirements for applicants to the combined M.D./Ph.D. program or the combined B.S./M.S. program in Physical Therapy, please see the respective sections of this catalog.

General Application Procedures

Applications to Ph.D. programs should be submitted by March 1 for optimal consideration for admission and fellowship support. Applications to M.S. programs are evaluated on a rolling basis. (Exceptions: March 1 deadline for the M.S. program in Occupational Therapy for applicants with a bachelor's degree in a field other than Occupational Therapy).

Under ordinary circumstances, all graduate students commence their studies at the beginning of the academic year. Under specific curricular circumstances and with the approval of the Dean, a student may begin graduate study during the

academic year. Application forms are available in the Office of Admissions of the College of Graduate Studies, or may be downloaded from the University web site at www.tju.edu.

The completed application form, the $40 application fee, and all supporting documentation, should be submitted to:

Director of Admissions
College of Graduate Studies
Thomas Jefferson University
1020 Locust Street, M-46
Philadelphia, PA 19107

Telephone: (215) 503-4400
Fax: (215) 503-3433
Email: cgs-info@mail.tju.edu

Application files are forwarded for review to the faculty of the respective programs when all required documentation has been received, including: 1) $40 application fee (or $30 re-application fee), 2) official academic transcripts (two copies each) of all undergraduate and graduate course work, 3) three letters of recommendation, preferably from individual faculty members or pre-professional committee members. Letters from professional contacts may be submitted in addition to, not in lieu of, letters from faculty members. Letters of recommendation should be from individuals able to assess the applicant's potential in relation to graduate degree requirements - areas to include scientific knowledge, interpersonal skills and academic ability.

Applications are not processed until all required documentation has been received. The application fee is non-refundable and cannot be waived. Transcripts and other documents submitted with the application are retained by the College of Graduate Studies and will not be returned to the applicant. Providing inaccurate or false information can result in immediate withdrawal of an application or retraction of an acceptance.

Acceptance for admission into the College of Graduate Studies is contingent upon acceptance into one of the approved departmental or interdepartmental graduate programs.

Application to Multiple Programs

It is permissible to apply to two graduate programs at time of application, but applicants must indicate the order of preference among the programs. The application will be reviewed in that sequence. The decision regarding each program will be conveyed to the applicant as soon as the evaluation is completed. The Ph.D. programs in Genetics, Immunology, Microbiology and Molecular Virology, and Molecular Pharmacology and Structural Biology (referred to as the "Joint" Ph.D. program option) provide a flexible-entry option whereby students are permitted to begin graduate study without commitment to a specific program. The Ph.D. programs in Developmental Biology and Teratology, and Pathology and Cell Biology offer the same flexible entry option. The selection of the degree program must be made by the end of the first year. For a more detailed description, see the respective program descriptions in this catalog.

Reapplication

Applications for admission are retained for three academic years. Candidates who wish to reapply must do so in writing and must provide pertinent documentation to update the application. The $30 reapplication fee is required at time of reapplication.

Combined M.D./Ph.D. Application Procedure

Admission standards are similar to the M.D. program; however, special attention is paid to research experience and to the quality of scientific preparation. Qualified applicants are selected to meet with faculty interviewers chosen for their involvement in research areas related to the specific interests of the applicants.

Applicants are required to submit an application form for admission to the combined degree program, a personal statement, copy of American Medical College Application Service (AMCAS) application and the MCAT scores, and three letters of recommendation. While GRE test scores are helpful, they are not required for admission to this program. Moreover, no additional application fee is required to apply to this program. Additional documentation such as research publications and special academic honors should be submitted with application. To expedite application review, it is requested that all supporting documentation be submitted at time of application to the Combined M.D./Ph.D. program.

Applications should be submitted to the following address:

Director of Admissions
College of Graduate Studies
Thomas Jefferson University
1020 Locust Street, M-46
Philadelphia, PA 19107

Telephone: (215) 503-4400
Fax: (215) 503-3433
Email: jessie.pervall@mail.tju.edu

Special Student Status

In exceptional circumstances, i.e., by recommendation of the director of the graduate program — and with the approval of the Dean, students whose academic record do not qualify for regular admission may enroll in limited course work under “special student” status. Provisions of acceptance, goals and expectations of accomplishment are specified at time of acceptance. In the course of the academic year, the student’s academic records are reviewed to determine whether regular matriculation status should be accorded. This option does not apply to students in the combined B.S./M.S. physical therapy program.

Non-Degree Student Status

Non-Degree enrollment status provides opportunity for individuals with bachelor’s degree or higher, the opportunity to enroll in a limited number of courses without being matriculated in a master’s or doctoral program. Applications for

non-degree enrollment and course listings are available in the Graduate Studies Admissions Office, and in the University Office of the Registrar. Students seeking to enroll under non-degree student status must meet course prerequisite requirements and obtain approval of course coordinator or Associate Dean.

Completed application and registration forms with required signatures must be submitted to the Graduate Studies Admissions Office. Undergraduate transcripts and completed personal data forms are also required. Please note that forms without required signatures will not be processed. Non-degree tuition charges are billed on a per credit basis.

Non-degree students may enroll for a maximum period of two years or six semesters. Students may register for no more than seven (7) credits in any semester. The maximum number of credits that can be taken in non-degree status is thirteen (13). Exception: maximum number for students pursuing a master's degree in Nursing or Occupational Therapy is six (6). If an application to these programs is pending, and approval granted by graduate program director, a student may be authorized to take additional courses while their application for matriculation is being considered. Non-degree students seeking to apply for matriculation to a graduate program should refer to the catalog section on General Admissions Requirements.

Course / Credit / Enrollment Information

A student is ultimately responsible for meeting all requirements for a degree and for graduation. Mentorship by advisors, faculty, the thesis research committee, and the deans is offered in an advisory capacity only; it is the student who must assure that all course, credit, and graduation requirements are fulfilled.

A student matriculated in a Ph.D. or M.S. program must maintain continuous enrollment each semester until completion of the degree, or must request a leave of absence from study from the director of the graduate program. The leave must be approved by the Dean of the Graduate College; see the section on “Leave of Absence” in this catalog. With regard to the full-time residency requirement, refer to the section on “Degree of Doctor of Philosophy, General Requirements,” in this catalog.

Foreign national students who hold an F-1 visa are required to be continuously enrolled in order to maintain lawful immigration status in the United States.

Enrollment / Registration

It is the responsibility of the student to be familiar with and observe the academic policies of the College in all matters including course registration, adding and dropping courses, and withdrawal from courses and/or the College, as stated in this catalog. While the College will maintain student records, it is the student’s responsibility to ensure that his/her academic record is accurate.

To receive credit for a graduate course, students must enroll through the University Office of the Registrar, at the time of registration prior to the beginning of each semester. Registration materials are mailed to all students and should be returned to the Registrar’s Office by the dates given on the academic calendar.

Each graduate student is also required to obtain an ID card through the Security Photo ID Center on campus. Refer to the section on Photo ID Center in this catalog.

Banner Web

The Banner Web information system is available for students and faculty to more conveniently access academic records and process routine academic functions. The Banner Web system can be accessed via the internet 24 hours a day, 7 days a week, by going to the Jefferson Pulse website http://pulse.jefferson.edu and following the links to Banner Web. Appropriate security features have been built in to maintain confidentiality of this information.

Features that are available through the internet include:

- Application for admission
- Application for financial aid
- Course registration
- Viewing of course schedules
- Viewing of final grades
- Request for transcript
- Payment for tuition charges
- Viewing and updating demographic information

Many of these on-line features are currently operational, but some will become available over the next few months. Please consult the Jefferson Pulse website for more information about these features and how to get your Personal Identification Number (PIN) and password for accessing Banner Web.

Email

The Graduate College will utilize email as the primary method of communicating information to our students. It is imperative that you review your Jefferson email messages. All students will be issued a Jefferson email account. You can contact the Graduate College or the Jefferson Information Technologies Office for more information about student email accounts.

Compliance with University Health Regulations

Upon admission to the College of Graduate Studies, all students in degree programs are required to provide to University Health Services a pre-matriculation report of medical history, health evaluation, and proof of inoculation. Appropriate forms are sent to all new students prior to the Fall Semester or prior to matriculation at any other time. The physical examination may be given either by the student's private physician, or at University Health Services at the student's expense.

A student must take care of this matter at time of matriculation; if he/she fails to comply with this regulation, the student will not be allowed to register for the following semester.

Please see section on "Health Insurance for Graduate Students" in this catalog regarding the requirement for health insurance coverage.

Laboratory Safety Training

OHSA (Occupational Health and Safety Administration) regulations state that all students who will be working in a laboratory setting are required to be trained in proper laboratory safety procedures. The Jefferson Department of Environmental Health and Safety provides this training for all new students following matriculation.

Courses

All courses listed in this catalog are available to students enrolled in a doctoral or master's program in the Graduate College, provided they meet the prerequisites for each course. The course coordinator may limit the number of students in a course. Individuals in non-degree status may also enroll in certain courses for credit, provided the conditions described under "Non-Degree Student Status" are met.

Each course is identified by a five character "designator." The first two letters are an abbreviation for the program offering the course (see key below), followed by a three digit number.

The first digit identifies the level of the course: 500-introductory, 600-advanced, 700-seminar/literature review, 800-master's clerkship and research, and 900-doctoral research. Sequential courses are generally differentiated by the second digit of the course number.

As circumstances require, the time period for a course may be changed, or the course may not be offered in a given academic year. Students are urged to refer to the Class Schedule which is issued at the beginning of each semester and identifies active courses for the current academic term. This list is available in the Office of the College of Graduate Studies and in the University Office of the Registrar, and the TJU website at http://www.tju.edu.

Key

AN - Anatomy (Jefferson Medical College core course available to CGS students)
BI - Biochemistry and Molecular Biology
DB - Developmental Biology and Teratology
GC - Graduate Center for Education and Training
GE - Genetics
ID - Interdisciplinary courses
IM - Immunology
LS - Laboratory Sciences
MI - Microbiology and Molecular Virology
NU - Nursing
OT - Occupational Therapy
PA - Pathology and Cell Biology
PR - Molecular Pharmacology and Structural Biology
PS - Physiology
PT - Physical Therapy
TE - Cell and Tissue Engineering

Credits

A full-time doctoral student must attempt no fewer than 20 credits for the Fall Semester, 30 for the Spring Semester, and 10 for the Summer Semester, with a total of 60 credits for the academic year. The Summer Semester is a period for study and research training for Ph.D. students. A doctoral student is considered part-time when carrying 60% or less of the total of 60 credits for the full academic year. (For part-time student regulations, see "Degree of Doctor of Philosophy—General Requirements" in this Catalog.) Jefferson students pursuing a Master of Science degree are matriculated into either a part-time or a full-time program. However, for national and state statistical reporting purposes, a student is considered a "full-time" student if carrying a course load of nine credits or more per semester.

One credit in graduate courses represents one hour of lecture or two hours of laboratory work per week for a minimum of twelve weeks. Credit for research is based upon the proportion of time spent therein.

Grading System

The following scale, effective the Fall Semester of 1994, gives the suggested numerical equivalent for faculty who wish to do the initial grading by using a numerical scale. Only a letter grade will appear on the official transcript.

Grade	Quality Points	Suggested Numerical Equivalent
A	4.0	90 or above
A-	3.7	87-89
B+	3.3	84-86
B	3.0	80-83
B-	2.7	77-79
C+	2.3	74-76
C	2.0	70-73
F	0.0	69 or below
S	—	Satisfactory/Pass
U	—	Unsatisfactory/Fail
W	—	Withdrawal
I	—	Incomplete

A student who places or tests out of a graduate level course which is a required course in that student's program, will receive the grade of "Satisfactory" for that course on his/her official transcript. Course credits will count toward the credit requirements for the degree.

Grade Point Average (GPA)

The grade point average is derived from the grades and credit hours of courses taken. For each course graded A through F, multiply the number of Quality Points (QPTS - see above for 4.0 scale) by the GPA Hour (GPAH - Courses graded A through F) credit value. Add the products of these multiplications for each course and divide that sum by the sum of GPA Hours to arrive at the GPA. Courses for which a student has the designation of S, U, W, or I and grades for transferred courses, are not included in the computation of the grade point average.

Grades are a part of the student's permanent record. Once submitted and entered on the student's transcript, no changes will be made to this record, with the exception of entering the final grade to replace an "I" or correcting an inappropriate grade. (Refer to "Change of Grade.")

Change of Grade

To change a student's grade of "I" (Incomplete) or to correct a grade, the professor/instructor should complete and sign a Grade Change form, available in the University Office of the Registrar. A student who believes that he/she has received an inappropriate grade should contact the instructor or course coordinator. If the outcome is not satisfactory to the student, further review may be pursued with the Dean of the Graduate College. A change of grade may be made within four weeks from the last day or final examination of the course.

Transcripts

At the end of each semester, each student in active status will receive an unofficial student transcript at no charge. In all other instances, a fee of $5 per transcript will be charged for each official transcript issued. All transcript requests must be in writing; a "Transcript Request Form" can be obtained from the Registrar's Office, or the request may be made in a signed letter or facsimile (fax). The College reserves the right to withhold transcripts from students under certain circumstances, such as defaulting on a loan or having financial obligations to the University.

An official transcript, printed on security paper, is identified by the raised seal of Thomas Jefferson University and the signature of the University Director of Student Records. Alteration or forgery of such a document is a criminal offense. The Family Educational Rights and Privacy Act of 1974 prohibits release of academic information to a third party without the student's written consent. Upon receipt of the written request by the student and the payment of the fee, the transcript may be released to the third party. If the third party requires the student to submit an official transcript with other materials, the transcript is stamped "Issued to Student," is enclosed in a sealed envelope with the signature of the Director of Student Records across the sealed flap, and is then given to the student to submit to the third party.

Changes of Schedule: Dropping and Adding Courses

Students who wish to revise their schedules after registration must complete a Drop/Add Form and return it with the signatures of their advisor or program director to the University Office of the Registrar. Students may drop a course before the third class meeting. A course that is dropped does not appear on the student's transcript.

Students, in consultation with their advisors, are responsible for making certain that any changes in schedule will fulfill requirements for the degree. Students receiving financial aid should also consult with the University Office of Financial Aid regarding the effect that changing their academic schedule may have on their eligibility for aid.

Students who stop attending classes without filing the required Course Drop form will be responsible for the full payment of tuition and may receive a failing grade for the course. Verbal notification to the course instructor or the Registrar's Office does not constitute an official course drop. Similarly, students who attend classes without properly registering for or adding a course will not receive credit for the course. The addition of a student's name to the class list by an Instructor does not constitute course enrollment.

Course Withdrawal

After the conclusion of the Drop period, students may withdraw from a course by obtaining the appropriate form from the University Office of the Registrar and securing the signatures of their advisor or program director. A student who is authorized to withdraw from a class prior to the date published in the Academic Calendar will receive a grade of "W" if the student's performance is at a passing level. If the student is failing at that time, a grade of "F" will be recorded. No credits or quality points are given for either grade, which will remain on the student's permanent record. However, the grade of "F" is included in the calculation of the student's grade point average, while the grade of "W" is not.

A student is not allowed to withdraw after the end of the third quarter of the course and will receive the grade or "F" if he/she does not complete the course. For the present purpose, the course begins the first day of that class, which may be later than the first day of the semester.

Students who stop attending classes without filing the required Course Withdrawal form will be responsible for the full payment of tuition and will receive a grade of "F" for the course. Verbal notification to the course instructor or the Registrar's Office does not constitute an official course withdrawal.

In order to receive credit for a course from which a student has withdrawn, the student must re-register for the course in a subsequent term.

Failure to Complete a Course

A student who has not met all requirements of a course, may be given the grade of "I" (Incomplete). A grade of "I" indicates that the instructor is not prepared to give a grade for the course because the student has not completed all requirements for the course. This grade automatically becomes an "F" if the work is not

completed and a grade is not submitted by the instructor within four weeks after the end of the course or the final examination.

Academic Probation

In order to be considered making satisfactory academic progress, the student is required to maintain a cumulative grade point average of no less than B (3.0). A student whose grade point average falls below B will be placed on academic probation. Students on academic probation have the two following semesters to make up the deficiency. [The Summer Semester is excluded from consideration in this context.] Students on academic probation who have not been able to obtain a cumulative grade point average of 3.0 or higher after two consecutive probationary semesters must petition the Graduate Council for permission to continue as a student in the Graduate College, or be discharged from the College. The student must submit the petition in writing to the Dean of the Graduate College for consideration by the Graduate Council. The petition should include pertinent, detailed information in support of the request to continue graduate study. The student must also request a written statement from the director of the graduate program; this statement should be forwarded to the Dean.

The Graduate Council will make a decision either to allow the student to continue study in the Graduate College or to dismiss the student. In the former case, Council will define a set of recommended conditions under which the student may be allowed to continue study. The decision of the Council will be provided to the student in writing and is final.

Failure in a Course

A student who receives a grade of "F" must petition the Graduate Council for permission to continue graduate study. The student must submit the petition in writing to the Dean of the Graduate College for consideration by the Graduate Council. The petition should include pertinent, detailed information in support of the request to continue graduate study. The student must also request a written statement from the director of the graduate program; this statement should be forwarded to the Dean.

The Graduate Council will make a decision either to allow the student to continue study in the Graduate College or to dismiss the student. In the former case, Council will define a set of recommended conditions under which the student may be allowed to continue study. The decision of the Council will be provided to the student in writing and is final.

The grade of "F" will remain on the student's permanent record and will be computed in the student's grade point average. No credit for the course will be earned.

Repeating a Course

A student who has been placed on probation or a student who receives a "C" in a course which is a requirement of the student's degree program, may be required to repeat the course. As a general policy, graduate students are encour-

aged to select courses which increase their scholarship. If a student requires additional exposure to a discipline, taking a new course in that area, rather than repeating a course, is strongly recommended. If a serious deficiency in fundamental knowledge is present, a student may request permission to repeat a basic course in that discipline, subject to the following stipulations:

A course may be repeated only once. The student must obtain prior approval from the student's advisor, program director, and the Dean. Whenever a course is repeated, no additional hours attempted will accrue, and the latter grade replaces the previous grade in computing the grade point average, and in assignment of academic credit. Both grades remain a part of the student's permanent academic record.

Auditing a Course

A student wishing to audit a course must obtain the approval of the course coordinator or instructor. No registration is necessary. Audited courses will not be recorded on the student's transcript.

Transfer of Credits

A student wishing to transfer credits for a graduate course, with a grade of B or above, earned at another institution, should submit a written request to the director of the graduate program at Jefferson, accompanied by a course description and a syllabus. An official transcript from the outside institution should be obtained if not already included in the student's academic file. The student should request from the director of his/her graduate program a written assessment in support of this request for credit transfer. All the above materials should then be forwarded to the Graduate College Dean's Office for review by the Student Affairs Committee of Graduate Council. A recommendation by the Committee will be made to Council for approval. Grades for courses for which transfer of credits is approved are not recorded on the student's transcript and are not used to compute the grade point average.

When necessary, credits from the other institution will be converted to credit equivalents in the College of Graduate Studies, as defined in this catalog. A maximum of 18 graduate course credits earned at another graduate college may be transferred to meet, in part, the 54 credit formal course work requirement for the Ph.D. degree. Six (6) didactic semester hours of graduate work earned at an accredited institution may be applied toward course requirements for Master of Science degree programs in Nursing and Occupational Therapy. Nine (9) didactic semester hours may be applied toward course requirements for Master of Science degree programs in the basic sciences. A maximum of twelve (12) semester hours of graduate work earned at an accredited institution may be applied toward course requirements for the Master of Science programs in Laboratory Sciences. Credits previously applied to an undergraduate degree will not be considered for transfer. Credits previously applied to a master of science degree may be eligible for transfer into the course requirements for either a master's or doctoral degree.

Change of Student Status

Any change in student personal data information or student status requires completion of the appropriate form which may be obtained in the University Office of the Registrar or may be available via the Banner Website.

Transfer of a Matriculated Student from One Program to Another

If a student wishes to transfer from one program to another, he/she must present the request to the Dean of the College of Graduate Studies. Requests must include the appropriate signatures. For doctoral students these will be at least the student, the director of the program from which the student is moving, the director of the program to which the student is transferring, and the advisor who is the student's new mentor. When applicable, the Joint Graduate Programs director will also need to sign. For master of science students in the basic sciences, the student's signed request should be delivered to the program director or academic coordinator. The student will receive written confirmation of the approved program transfer at the time it is forwarded to the Registrar. It is the responsibility of a doctoral student to inform the Office of Finance of any change in funding source arising from the program transfer.

Leave of Absence

A student in good standing asking for a leave of absence from the College is required to submit a written request to the director of the graduate program indicating the effective dates and reason for the leave. The student should also request a letter of support for the leave from the program director, and the student's physician in the case of leave for a medical reason. The student should forward the request, accompanied by the above letter(s), to the Dean's Office for final approval. The student will receive a written confirmation or denial of the request for a leave.

By a prescribed date, as noted in the confirmation letter, the student must notify the Dean's Office and the University Registrar of his/her intention to return to graduate study. A leave of absence may be granted for a maximum of one year. The student, however, may return to graduate study prior to the designated end of the leave, provided due notice is given to the Graduate Office and to the University Registrar. If the student does not return to graduate study by the end of the leave, the student may be administratively withdrawn from his/her graduate program. A leave will not be granted to students with outstanding financial obligations to the University.

Withdrawal from the College

Students wishing to withdraw from the College must do so in writing, specifying an effective date, to the Dean. Proper notification must also be made to the student's advisor and program director. A withdrawal will not be granted to students with outstanding financial obligations to the University. The official date of withdrawal is normally the date approved by the Dean. The student will receive written notification of the decision for withdrawal from the Graduate College.

Graduation

Candidates for degree of Doctor of Philosophy must have successfully defended a scholarly dissertation, earned the credits and completed other course requirements in their program of study, and have a cumulative grade point average of B (3.0) or higher on all work attempted.

Candidates for degree of Doctor of Philosophy must deliver two bound copies of their thesis to the College of Graduate Studies, along with one unbound copy for microfilming. Candidates for a Master of Science degree in the basic sciences must submit one bound copy of their thesis to the College of Graduate Studies. All financial commitments to Thomas Jefferson University must be fulfilled prior to graduation, including payment of late library fines, housing fees, and tuition. The student's diploma will be withheld until the above criteria are met.

Candidates for the degree of Master of Science must have successfully completed all credits and other requirements of the program, and have a cumulative grade point average of B (3.0) or higher on all work attempted.

It is the policy of the College of Graduate Studies not to award honors to graduates with the doctor of philosophy or master of science degree.

Graduation: Diploma; Cap, Gown, and Hood

Each student expecting to graduate in a given year should notify the University Office of the Registrar prior to the final semester of degree completion. All students eligible for graduation will be sent graduation materials by the Registrar's Office. These materials include an Application for Degree Certificate which *must* be completed and submitted by the date published in the Academic Calendar, order forms for the diploma and cap and gown for Commencement Exercises and information about the ceremony and rehearsal times. The cap, gown, and hood become the property of the graduate. Their cost and that of the diploma are fully covered by the College of Graduate Studies. The cost of replacing a diploma lost or damaged by the alumnus/a is the responsibility of that alumnus/a. Request for replacement diploma should be made to the University Office of the Registrar.

Microfilm Repository for Theses

As a service to its graduates, it is the practice of the College of Graduate Studies to place all Ph.D. theses in the University Microfilms International (UMI) microfilm repository, at no cost to the student. Information about this service, administered by UMI, is distributed by the Dean's Office.

Survey of Earned Doctorates

The College of Graduate Studies participates in the annual graduate survey administered by the National Opinion Research Center (NORC) at the University of Chicago. The survey is distributed by the Dean's Office.

Other Regulations and Procedures

Student Rights, Freedoms, and Responsibilities

The University policy on Student Rights, Freedoms, and Responsibilities is reproduced in its entirety in the "Policies" section of this catalog.

Policy and Procedures for Responding to Alleged Misconduct in Research

The Graduate College policy on Alleged Misconduct in Research is reproduced in its entirety in the "Policies" section of this catalog.

Code on Professional Conduct

The faculty and students of the College of Graduate Studies are engaged in research and scholarly activities aimed at increasing our understanding of the basic tenets of science. These activities oblige the participants to adhere to a high standard of ethical behavior. Any breach of ethical standards (such as deception or falsification of data) by those engaged in research activities must be considered a serious threat to the integrity of this mission.

Policy on Professional Conduct

Allegations of misconduct are to be reported to the Dean of the College of Graduate Studies. The Dean or his designate shall conduct a preliminary review of the allegation to determine whether an investigation is warranted, and when required, initiate the appropriate procedure for an impartial review. If alleged faculty misconduct involves issues related only to graduate education, the review shall be conducted by the College of Graduate Studies. If the allegation involves research or other matters which are of concern to the college in which the faculty member holds his/her primary appointment, the matter should also be reviewed using the procedures established in that college. Allegations of student misconduct will be reviewed in accordance with the University policy on Student Rights, Freedoms, and Responsibilities. This policy is printed in its entirety in the "Policies" section of this catalog.

Confidentiality of Student Records

Student records are held by the College in accordance with the requirements of the Family Educational Rights and Privacy Act, reproduced in its entirety in the "Policies" section in this catalog. Such records are the property of the College but may be released upon written request of the student.

Veterans Registration

The University is approved for training veterans and children of veterans under the appropriate Public Laws. All students who wish to obtain educational benefits should apply to the nearest office of the Veterans Administration for a certificate of entitlement in advance of the registration period. All questions on veterans registration should be addressed to the Associate University Registrar (215) 503-8734.

Photo ID Center

Each matriculated student is issued a "Graduate Student" Photo ID card through the Photo ID Center (Security), on the first floor of the Barringer Building, at 924 Walnut Street. A non-degree student may be issued a temporary ID card (without photo) which remains in effect for the semester during which that student is enrolled in a graduate course. The card may be renewed. An ID card is used to allow access to all buildings on campus, borrow books from the library, allow entrance to Commons facilities and for other various activities related to the College. It is the student's responsibility to maintain a current ID card.

New degree program students may obtain the ID during Orientation or may go directly to the ID center for processing of the card. Non-degree students and students who have lost ID's should first pick up an ID authorization letter from the University Office of the Registrar, ground floor of the Curtis Building. There is a charge for replacement of lost ID's.

Fees and Expenses

The Board of Trustees reserves the right to amend or add to the regulations concerning fees and method of payment and to make such changes applicable to present as well as future students.

Graduate Student Fees

The comprehensive fee covers all fees for graduate students matriculated in full-time programs including tuition, laboratory use, graduation costs, and student Commons facility fees. Students matriculated in part-time programs and all students who take courses on a non-degree basis will be charged tuition fees on a per-credit basis. The maximum tuition that a matriculated student is charged each academic year will not exceed the comprehensive fee for a program at the same degree level.

In the 2001-2002 academic year, the comprehensive tuition fee for graduate students in the Ph.D. programs is $13,440. All or part of the tuition fee may be paid from a fellowship award. In order to continue receiving a fellowship award, including stipend, doctoral students must complete registration each semester — including semesters devoted to thesis research. The Graduate College Finance Office will arrange processing of all doctoral student fellowship awards.

Tuition and fees in the Master of Science degree programs in biomedical chemistry, developmental biology and teratology, microbiology, and pharmacology, as well as the Certificate programs in clinical research, public health, and research management are $625 per credit in 2001-2002. The maximum tuition that a matriculated student is charged each academic year will not exceed the comprehensive fee for a program at the same degree level. For these programs, the maximum fee is $18,060 in 2001-2002.

Tuition and fees in the Master of Science degree programs in laboratory sciences, nursing, occupational therapy, and physical therapy are $685 per credit. The maximum tuition that a matriculated student is charged each academic year will not exceed the comprehensive fee for a program at the same degree level. For these programs, the maximum fee is $19,800 in the 2001-2002 academic year.

The per-credit tuition fee for non-degree students is $685 per credit in the 2001-2002 academic year.

Prorating of Tuition for the Fall Semester of the Final Year of Study for Full-Time Ph.D. Students

A full-time Ph.D. student who is in the final phase of completing all requirements for graduation may attend the College of Graduate Studies under the prorated tuition option if the student:

a) has completed all course work,
b) has completed all laboratory research,
c) is only writing his/her thesis, and
d) will defend his/her thesis prior to end of the calendar year.

If these conditions are met, the tuition will be prorated to the date of defense, provided a successful thesis defense takes place on or before December 31. It is the practice of the College of Graduate Studies to charge one half of full-time tuition for the Fall Semester and one half of full-time tuition for the remainder of the academic year. If the student fails to defend the thesis on or before December 31, the full year tuition will be charged to the source funding the previous semester, or other appropriate funding sources.

In terms of academic credit, the student will earn 10 research credits if the defense date falls before November 1. Twenty (20) research credits will be earned if the defense date falls between November 1 and December 31.

Payment of Tuition Fees by Employer Tuition Benefit Programs

Graduate students may have all or a portion of their tuition fees paid through an employer-based tuition benefit program. Please be aware that the student is responsible for arranging payment of all fees when due. Any arrangements for tuition payment or reimbursement from an employer or other agency must be made between the student and the employer/agency. Employees of Thomas Jefferson University who are taking graduate courses need to refer to the University's Tuition Reimbursement Policy for specific details and conditions of receiving tuition benefits. Information about tuition reimbursement and all necessary forms are available in the Human Resources Department Benefits Office on the first floor of the Martin Building, 201 South 11th Street, Telephone (215) 503-6785.

For employees at other institutions, please contact your employer for specific details on tuition benefit programs. Questions related to payment of tuition benefits from other institutions can be directed to the University's Tuition and Cashier's Office, 521 Scott Building, located at 1020 Walnut Street, Philadelphia, PA 19107, Telephone (215) 503-7669.

Refund of Tuition

A student who is granted a leave of absence, or who withdraws from a graduate program or class to which he/she had registered during the academic year, may request a partial refund of tuition fees in accordance with the following conditions:

Leave or withdrawal by the end of:	Refund
Drop Period (First three weeks of classes)	100%
Thereafter	0%

Students may receive a refund only on funds they have paid.

The effective date of withdrawal is the date on which the student's written request for withdrawal is received and accepted in the University Registrar's Office.

No student will be granted a withdrawal or a leave of absence who has not paid in full all of his/her obligations to the College of Graduate Studies.

A student who is suspended or dismissed because of a violation of College or University regulations shall receive no refund.

Payment of Fees

Payments of all fees, including tuition, may be made in cash, by check, bank draft, money order, Visa or MasterCard at the University Tuition and Cashier's Office, Thomas Jefferson University, 521 Scott Building, 1020 Walnut Street, Philadelphia, PA 19107, (215) 503-7669. All payments are due by the date indicated on the invoice. Any unpaid balances after this date will be assessed a $25 per month late fee. Extended payment plans may be available through the University Tuition and Cashiers Office.

Any student who fails to complete registration, including the payment of all financial obligations due the University, shall be deprived of the privileges of the College. Payment of all outstanding financial obligations must be completed in order to receive credit and grades for the semester in which he/she is currently enrolled and to be permitted to enroll for the following semester. Should the student default on any tuition payment, it will result in submission of the account to a collection agency. All attorney's fees, collection costs, and charges necessary for the collection of any amounts not paid when due will be the responsibility of the student.

Financial Aid

Fellowships: Full-Time Ph.D. Candidates

A limited number of fellowships are available on a competitive basis for the support of full-time Ph.D. degree students with a strong academic background and research potential. The awards provide for the full cost of tuition and a stipend for the student's essential living expenses.

The fellowships for 2001-2002 provide $13,440 for tuition and $18,000 for stipend.

Fellowship funds are derived from several sources such as training and research grants, as well as endowment sources such as the Percival E. and Ethel Brown Foerderer Foundation.

Fellowships are awarded to eligible full-time graduate students as a means of financial support for graduate study. Graduate study involves active participation in academic studies, as well as in laboratory research and teaching. The fellowship is contingent upon maintaining active, full-time status in good standing and ongoing participation in all aspects of the Ph.D. program on a daily basis.

Full-time doctoral students cannot, during the fellowship period, engage in any employment that would interfere with their academic requirements. It is the responsibility of the student to keep the advisor and the graduate program committee informed of any employment activities.

A matriculated student who is not receiving financial support from any University fellowship, is solely responsible for his/her financial funding. If, for any reason, that student's source of financial support ends, Thomas Jefferson University is under no obligation to give financial assistance to that student. Financial aid information is available through the University Office of Financial Aid.

Specific information about these fellowship opportunities is available in the Graduate College's Finance Office, Suite M-63, Jefferson Alumni Hall.

General Financial Aid Information

Information in this section is accurate at the time of printing. Future changes in federal regulations or institutional policies may change the application requirements or program guidelines. Please contact the University Office of Financial Aid, Room G-1 College Building, or at (215) 955-2867 regarding student financial aid matters.

Student Eligibility

To be considered for federal or institutional financial aid, a student must be a U.S. Citizen or eligible non-citizen, accepted into a degree-granting program, maintain at least a half-time (5 credits) student status as a matriculated student, and may not be in default on any prior educational loan.

Citizenship

A student must be a U.S. Citizen or permanent resident to receive federal financial aid consideration. In the case of permanent residents, photocopies of both sides of the I-151 or I-551 card must be submitted to the University Office of Financial Aid with the College of Graduate Studies Institutional Application.

Application Procedures

The primary responsibility for financing the costs of graduate education rests with the student. Need-based financial aid is available to all qualifying students by completing all necessary requirements and documentation. The objective of this assistance is to provide funds in the form of federally sponsored loans and part-time, on campus employment opportunities to students who would not be able to complete their education without assistance. Some academic merit based funds are available for students enrolled in certain programs. Awards are made by each of these programs. The University Office of Financial Aid is available for counseling students regarding the application process for all need-based aid consideration.

Students who wish to apply for need-based aid are required to demonstrate an "unmet need." Unmet need is defined as the cost of attendance at the University less the available resources, including any outside aid. Need is determined on the basis of a confidential financial statement, the Free Application for Federal

Student Aid (FASFA), completed by the student. All financial aid is awarded for one academic year. Students must submit new applications each year to be considered for aid. Applications packets are available in January in the University Office of Financial Aid, Room G-1, College Building.

Application for Federal Financial Aid Consideration

Free Application for Federal Student Aid (FASFA)

Students may either complete the blank FASFA included in the financial aid packet or the FAFSA on the web. DO NOT COMPLETE BOTH FORMS. Unused blank FASFA forms should be returned to the University Office of Financial Aid for recycling. Processing of the FASFA application will take approximately four to six (4-6) weeks. The College of Graduate Studies Title IV code that must be included on the FASFA application is **E00799**.

College of Graduate Studies Institutional Application

This form must be completed and submitted directly to the University Office of Financial Aid by all students applying for any type of financial aid.

Official Copy of Internal Revenue Service Form 1040 / Non-Filing Application Form

All students applying for financial aid must submit signed copies of their (and spouse's) IRS 1040 (A or EZ) forms for the prior year. Submit the copies of the IRS forms directly to the University Office of Student Financial Aid, along with the College of Graduate Studies Institutional Application. Students who have not and will not file an income tax return for the prior year must submit a signed copy of the "Non Filing Statement." These forms can be obtained by contacting the University Office of Financial Aid.

Deadline Date for Application

For campus-based federal financial aid (Federal Work Study, Federal Perkins and Nursing Loans) and institutional financial aid consideration, priority is given to applicants who have submitted all application materials by **MAY 1**. For consideration for the Federal Stafford Loan program, application can be made before and during the academic year. Processing of the Federal Stafford Loan application usually takes four to six (4-6) weeks once the students financial aid application is complete.

Sources of Financial Aid

Long term financial aid in the form of loans and federally-subsidized part-time employment is available to students pursuing graduate studies either at the doctoral or master's level. Federal loans have interest rates which are below market commercial rates and, at the present time, include an opportunity for eligible students to defer repayment. Some of these loans are from federal sources and are available only to students who are U.S. citizens or Permanent Residents, are enrolled on at least a half-time basis, accepted in a degree granting program, and are making satisfactory academic progress towards a degree.

Disbursement of all financial aid will occur during the first week of each semester (September, January, May/June). Specific dates can be obtained from the University Office of Financial Aid.

Federal loans are available to students through the Federal Family Education Loan (FFEL) programs. These loans are awarded on the basis of the student's demonstrated financial need, after the estimated student contribution has been determined through the FAFSA. Federal loans have a repayment schedule of ten (10) years. The student has an opportunity to consolidate these loans and extend the repayment period. Further information about the terms, sample repayment schedules, the necessity of repayment, entrance and exit counseling, and terms and conditions of employment that is part of a student's financial aid package is available by contacting the University Office of Financial Aid.

Federal Stafford Loans (Formerly the Guaranteed Student Loan (GSL))

This program offers students the opportunity to borrow educational loans at below market interest rates. These loans are made available through cooperative efforts of the federal and state governments and participating private and commercial lending institutions. Graduate students are able to apply for a maximum of $8,500 in need-based subsidized Stafford Loans and a total of $18,500 per academic year in a combination of Federal Subsidized and Unsubsidized Stafford loan funds.

The federal government pays the interest on a need-based subsidized Federal Stafford Loan while the student is enrolled at least half-time (5 credits); on a non-need based unsubsidized Federal Stafford Loan, the interest accrues while in-school and the student has the option to pay the interest monthly or defer the interest payments until a later date. Repayment of principal and interest begins six months after the termination of at least half-time study.

For Federal Stafford Loans disbursed after 7/1/98, the formula for determining the in-school interest rate is 91 day T-Bill plus 1.7%. This variable interest rate will change every July 1. However, the maximum interest rate will never exceed 8.25%. An aggregate limit of $65,500 subsidized and $73,000 unsubsidized (including any loans outstanding from undergraduate study) funds may be borrowed from this program.

Application material and Federal Stafford Loan Master Promissory Notes (MPN) may be obtained by contacting the University Office of Student Financial Aid. All applicants will have their eligibility for the Federal Subsidized Stafford Loan determined before being considered for the Federal Unsubsidized Stafford Loan. The College of Graduate Studies school code for the Federal Stafford Loan program is **012393-03**.

Federal Perkins Loans (Formerly the National Direct Student Loan (NDSL))

This low-interest loan program offers loans to students who demonstrate significant financial need. The interest rate on this loan is 5%, which is subsidized by the federal government until repayment begins. The maximum a graduate student may be awarded under the Federal Perkins Loan program is $6,000 per academic year and $40,000 as the aggregate maximum from this source. This total includes all Federal Perkins/NDSL loans awarded in undergraduate, graduate, and professional schools. Consideration for this program is made through submission of the financial aid application materials prior to the May 1 deadline and is contingent upon availability of funds.

Federal Nursing Student Loan Program

The Federal Nursing Loan program provides low-interest loans to nursing students who demonstrate significant need. The loans are repayable over a ten year period at an interest rate of 5%. Recipients are selected in accordance with guidelines published by the U.S. Department of Health and Human Services. Consideration for this program is made through submission of the financial aid application materials prior to the May 1 deadline and is contingent upon availability of funds.

Federal Work Study Program (FWS)

The Federal Work Study program offers funding for on campus employment. These funds may be used to assist in paying educational expenses. Federal Work Study is a need-based program. The administration of this program is in accordance with the guidelines established by the U.S. Department of Education. Consideration for this program is made through submission of the financial aid application materials prior to the May 1 deadline and is contingent upon available funds.

Thomas Jefferson University Institutional Loan Fund

Low-interest loans from institutional sources may be available to graduate students who demonstrate significant financial need. Consideration for these loans is made through submission of the financial aid application materials prior to the May 1 deadline and is contingent upon availability of funds.

Private Credit-Based Alternative Loans

Alternative loans may be used to supplement other financial aid to assist in meeting unmet educational costs. These loans can be utilized to fill the gap between the educational expense budget created by the University Office of Financial Aid and the combination of federal, institutional, and private financial aid received by the student for an academic year. These loans are not need-based but do have strict credit requirements.

Further information about these sources of loans can be obtained from the University Office of Financial Aid.

Emergency Assistance Advances

Short-term loans may be available to graduate students in emergency situations. These short-term loans are advances on pending financial aid. Loans must be repaid in full within 60 days. The short-term loan program is administered by the University Office of Student Financial Aid.

Student Expense Budgets 2001-2002

Per federal regulations, the University Office of Financial Aid provides an estimated educational expense budget for students enrolled in the College of Graduate Studies. This budget provides items including fixed and estimated costs for living expenses, transportation, books, supplies, and other educational expenses.

Living expenses are calculated by utilizing the Federal Bureau of Labor Statistics published cost of living expenses for the Philadelphia-South Jersey area. This budget is also utilized to calculate unmet financial need to determine financial aid eligibility.

STUDENT NON-TUITION EXPENSE BUDGET*
12-Month Budget
Single Student (No Dependents)
Commuter (from parent's household)

Room & Board	$4,071
Health Insurance (estimated)	1,250
Books & Supplies	1,075
Transportation	3,260
Other	1,380
Total	$11,036

STUDENT NON-TUITION EXPENSE BUDGET*
12-Month Budget
Single Student (No Dependents)
Non-Commuter

Room & Board	$13,440
Health Insurance (estimated)	1,250
Books & Supplies	1,075
Transportation	850
Other	1,255
Total	$17,870

*Increases or decreases in the Student Expense Budget may occur due to actual enrollment status, marital status, the number of dependents, housing status, and financial obligations experienced by the student and/or student's family.

Financial Aid Policies and Procedures

Verification Policy

The University Office of Financial Aid verifies each application using the student's IRS tax forms and Institutional Aid Application. The federal government requires that students who are selected must document that the information contained in the Financial Aid Application is correct. It is important to emphasize that until the verification process has been completed, your financial aid award will not be processed.

Entrance Interview Requirement

Federal and institutional regulations require that all first-time federal loan borrowers at the College of Graduate Studies attend a Loan Entrance Interview. Please note that no Federal Perkins or Federal Nursing Loan promissory notes can be signed nor Federal Stafford Loan disbursement can be issued until this loan counseling session has been completed. Small group sessions are held on pre-scheduled dates beginning in June and continue through September.

Exit Interview Requirement

If you received a federal or institutional loan at any time during your attendance at the College of Graduate Studies, federal and institutional regulations require

you to attend an Exit Interview prior to graduation, withdrawal, or when enrollment would drop below half-time status. The purpose of these interviews is to assist students in preparing post-enrollment repayment schedules, and to answer any questions concerning student rights and responsibilities. A summary of loan indebtedness is provided with the identity of the student loan lender, information on deferment and repayment, and an estimate of your monthly payments. You may not be cleared for graduation until this requirement has been satisfied.

Satisfactory Academic Progress

In order for a student to receive payment for any federally funded, Title IV Financial Aid Program, students must maintain satisfactory progress in their chosen program of study. If a student transfers to another program of study in the Graduate College, academic work in the prior program will be considered in determining satisfactory progress.

Students receiving aid for the first time must have been making satisfactory progress prior to receiving Title IV aid.

The University Office of Financial Aid will follow the Graduate College's academic policy for Satisfactory Academic Progress and probation. In order to be considered making satisfactory academic progress, the student is required to maintain a cumulative grade point average of no less than a 3.0. A student whose grade point average falls below a 3.0 will be placed on academic probation. The student's cumulative grade point average will be determined by the University Registrar. Students on academic probation have two (2) semesters to make up the deficiency. The Summer Semester is excluded from consideration in this context.

During the two (2) semester probation period, the student and the student's graduate program advisor need to present a plan by which the student will be able to achieve a grade point average of 3.0 by the end of the two semester probation period. The University Office of Financial Aid will consider this plan as a measure of the student's ability to progress to a 3.0 within the specified time period. If a plan is not prepared or a 3.0 is judged not to be attainable within the two semester time period, the University Office of Financial Aid will determine the student to be ineligible for Title IV federal aid consideration.

If at the end of the two semester period in which the student was on academic probation, the student does not achieve a 3.0 cumulative grade point average, the University Office of Financial Aid will determine the student to be ineligible for Title IV federal financial aid for the following Fall or Spring semester.

In addition to the grade point average condition described above, a student must successfully complete 70 percent of the credits attempted while receiving Title IV funds to be considered as maintaining satisfactory progress in their program of study.

Students progressing to the graduate level of a combined graduate/undergraduate program will be assessed the Satisfactory Academic Progress Standard applicable to the last college in which they were enrolled.

The University Office of Financial Aid understands that during any period of time, a student may still be enrolled at the Graduate College, but under conditions described above, the student may not be determined to be eligible for Title IV federal financial aid.

A Doctoral student is required to complete his/her course of study within seven (7) years of the date of matriculation in the Graduate College. A Master of Science student will have four years and one semester (4.5 years) to complete his/her course of study after the date of his/her date of matriculation. A Master of Science in Physical Therapy student will have one year and one semester (1.5 years) to complete his/her course of study after the date of his/her date of entry into the Graduate College.

This policy will apply to each matriculated student according to degree, regardless of full-time or part-time status for any or all semesters.

The University Office of Financial Aid will review the Satisfactory Academic Progress of its students who received Title IV federal funds once each academic year at the end of the Spring Semester. For those students who do not demonstrate satisfactory academic progress, review of their academic status will occur at the end of the first semester in which they did not qualify for Title IV federal financial aid.

Students who believe that they have not been judged fairly or have extenuating circumstances may request a review of their individual circumstances with the University Office of Financial Aid. In the event that a student is not satisfied with a decision made by the University Office of Financial Aid, he/she may appeal directly to the University Director of Financial Aid. A subsequent appeal may be made to the Dean of the Graduate College, who will render the final decision.

In the event of highly unusual or extenuating circumstances which result in the student not maintaining satisfactory progress, the University Office of Financial Aid may waive or adjust the Satisfactory Progress Policy on an individual basis. The death of a family member or documented medical illness are examples of unusual and extenuating circumstances.

Students who do not demonstrate satisfactory academic progress are not eligible to receive further Title IV federal funding until they have re-established satisfactory progress. To re-establish satisfactory academic progress, a student must successfully achieve at least a 3.0 cumulative grade point average. Determination of re-establishment will occur at the end of the semester in which the student did not receive Title IV federal funding.

Higher Education Amendments (1998) - Return of Title IV Funding

The Higher Education Amendments of 1998 require that when a recipient of Title IV grant or loan assistance withdraws from an institution during a payment period or period of enrollment in which the recipient began attendance, the institution must determine the amount of Title IV grant or loan assistance (not including Federal Work Study) that the student earned as of the student's withdrawal date.

The steps required to complete this process are as follows:

1. Determine date of withdrawal and percentage of payment period attended by the student.
2. Calculate amount of Title IV aid earned by the student.
3. Compare amount earned and amount disbursed to determine amount unearned.
4. If amount earned is greater than amount disbursed, determine late disbursement.
5. If amount earned is less than amount disbursed, determine amount of Title IV aid must be returned.
6. Calculate portion of funds to be returned by institution and student.

Students are encouraged to contact the University Office of Financial Aid if they have additional questions regarding the policy.

Definitions:

Academic Year

For the purpose of Title IV aid, a period of at least thirty weeks of instructional time which a graduate student is expected to complete at least 5 credits (half time credit level) each scheduled semester.

The scheduled academic year, as published by the College of Graduate Studies, begins and ends at approximately the same time each year according to an established schedule:

Fall Semester	September: 1st/2nd week through December: 2nd/3rd week
Spring Semester	January: 1st/2nd week through June: 1st/2nd week
Summer Semester	June: 2nd/3rd week through August: 4th week

Title IV Programs: These federal financial aid programs include the Federal Perkins Loan.

Title VII programs: These federal financial aid programs include the Federal Nursing Student Loan.

Credits Attempted: Credits will be considered attempted only for those courses in which a student is enrolled and which fulfill degree requirements. Withdrawal from classes or the College of Graduate Studies after the specified drop/add period does not exclude those credits from being considered as attempted. Required courses that are repeated will not be considered for aid eligibility, but these credits will be considered in calculation of credits attempted for satisfactory progress. Non-credit, remedial courses or challenge examinations are not considered for aid eligibility and are not considered as credits attempted.

Temporary letter grades such as I (Incomplete) will be considered at the time the final grade is received. These credits will be evaluated with the other credits the student attempted during the academic term in which the course was originally intended to be completed.

Successful Completion: Credits will be considered as successfully completed if the student receives a letter grade of A, B, C, or S (Satisfactory/passing). Credits which the student receives the grade of W, F, U (Unsatisfactory/failing) will not be considered successfully completed.

Awards

Several awards and scholarships are offered through the Graduate College. Some of these awards are described below. Specific details of these and other awards are available in the Graduate College's Finance Office in M-63, Jefferson Alumni Hall.

Loretta F. Rocco Memorial Scholarship

The scholarship was established in memory of Loretta F. Rocco, a 1974 graduate of the Master's Degree Program in Clinical Microbiology. The scholarship is awarded each year to a master's degree student in Microbiology on the basis of academic excellence and financial need.

College of Graduate Studies Alumni Travel Fellowships

These awards, made possible through a gift from the Graduate Studies Alumni Association, are used to assist graduate students attending national or other major scientific meetings related to their program of study. Applications for these funds are available in the Graduate College's Finance Office in room M-63, Jefferson Alumni Hall.

College of Graduate Studies Alumni Thesis Prize

This award, made possible through the support of the College of Graduate Studies Alumni Association, is given to a candidate for the Doctor of Philosophy degree for an important original contribution to scientific literature.

Foerderer Grants for International Study

The Foerderer Foundation has approved grants for Thomas Jefferson University students to use for a study abroad experience. Students in the College of Graduate Studies have the opportunity to present a study plan and apply for funding to supplement a partial personal contribution to the costs. Applicants must submit a proposal including the objectives and outcomes of the experience, designated faculty mentors both here and abroad, and a description of the site. If you have questions or need access to resources for developing a study plan, contact the Office of International Exchange Services for assistance.

Fredric Rieders Graduate Student Recognition Awards

These awards are given to graduate students in recognition of valuable contributions made to the Graduate Community at Jefferson.

Clinical Microbiology Alumni Scholarship

The scholarship was established in memory of Jane Stipcevich, a graduate of the Master's Degree Program in Clinical Microbiology. The Scholarship is awarded each year to a master's degree student in Microbiology for textbook and educational expenses.

Rose S. Smith Award

This award, made possible through a gift from the Edward F. and Rose S. Smith Trust, is given to a candidate for the Doctor of Philosophy degree in Physiology for travel to scientific meetings.

Ph.D. Programs

General Requirements

A minimum of three years of full-time study (i.e., 180 credits) beyond the baccalaureate is required for the Doctor of Philosophy degree. In most instances, completion of requirements for the Ph.D. degree requires four to five years of study.

A student with a master's degree in a related field, a doctoral degree in medicine, veterinary medicine or dentistry, or successful completion of graduate course work at another institution may be granted up to a maximum of 18 graduate course credits toward the Ph.D. degree. However, in no case shall less than one year of residence (full-time status at Jefferson) be spent at Thomas Jefferson University.

At least 30 percent of the credits (a minimum of 54) must be obtained from formal course work, of which one third (a minimum of 18) must be in disciplines other than that of major concentration.

The Graduate College requires successful completion of GC 640 - Research Ethics: The Responsible Conduct of Research, of all doctoral students.

Ph.D. Enrollment on a Part-time Basis

The Ph.D. degree will not be awarded for study taken wholly on a part-time basis. However, a Ph.D. student who enrolls primarily on a part-time basis is subject to all requirements of the Graduate College and of the student's doctoral program in the earning of the Ph.D. degree. The student must spend at least two consecutive semesters in full-time residence in the College of Graduate Studies of Thomas Jefferson University. During that time, he/she cannot be employed full-time elsewhere. The part-time Ph.D. student is to choose a faculty advisor by the conclusion of the first year of study and laboratory research rotations. For any semester during which the student has part-time status, he/she may earn no more combined course and research credits than 60% of the combined number of credits earned at full-time status (60 credits annually).

Program of Study

The Guide to the Ph.D. Degree and Thesis Manual, describing the Ph.D. program of study, is given to each Ph.D. student and member of the Graduate Faculty. Copies are available upon request in the Office of the Dean, M-63, Jefferson Alumni Hall.

In consultation with the student's research advisor, the director of the graduate program will recommend to the Dean the appointment of a Research Committee to assist the student in establishing a program of study. The Research Committee reviews the program bi-annually, and adjustments are made when necessary. In addition to mastering the major field of study, the student's course work must include other supporting biomedical sciences.

If the individual program of study requires graduate courses that are not offered at Thomas Jefferson University, these may be taken at an approved school and the credits and time will be applied to fulfillment of graduate study requirements.

Under the Cooperative Graduate Program, graduate course offerings in the basic sciences of certain other graduate schools in the Philadelphia area are available without payment of additional tuition.

Within the first year and a half of graduate study, the student begins research in the laboratory of his/her research advisor, leading to the completion of the doctoral thesis. The research advisor is primarily responsible for overseeing that an appropriate level of scholarship is exhibited by the thesis. The thesis must demonstrate a high degree of professional competence; it is the candidate's Research Committee that can give him or her the guidance and instruction necessary to achieve this competence. The Research Committee should meet regularly, at least twice a year, during the student's period of research activity. Records of these meetings should be kept on file in the graduate program. Research for graduate credit may be conducted in a department of Jefferson Medical College other than in a basic science department or in an organized research unit or center of a hospital or institution affiliated with Thomas Jefferson University, provided the research advisor is a member of the Graduate Faculty. In general, research work conducted outside Thomas Jefferson University or affiliated institutions will not be acceptable for graduate credit if initiated before admission.

A student becomes a candidate for the degree of Doctor of Philosophy after passing the comprehensive (preliminary) examination, which may consist of a written and/or oral part. The examination may be taken only after successful completion of appropriate course work. It is often held at the end of the second year, and in every case, not later than six months before the final defense-of-thesis examination. The comprehensive (preliminary) examination is designed to ascertain the candidate's knowledge of his or her field of study.

The members of the panel for the comprehensive (preliminary) examination are appointed by the Dean upon the advice of the director of the graduate program and may include representatives of other departments.

Dissertation (Thesis) and Final Examination

As evidence of successful research, each candidate must produce and defend a scholarly dissertation based on an investigation that constitutes a distinct contribution to knowledge. A copy of the doctoral thesis, prepared in accordance with the guidelines established by the College of Graduate Studies, must be presented to the Dean not less than three weeks before the final examination.

The final examination consists of a defense of the student's thesis before a panel appointed by the Dean, consisting of members of the student's Research Committee and other members of the faculty. It may also include scholars from other institutions. Following the final examination, the candidate must provide two bound copies of the dissertation to the Office of the College of Graduate Studies for deposit in the University Library. In addition, one unbound copy of the approved thesis must be submitted to the office for microfilming by Bell Howell. This copy will be returned to the candidate following return from microfilming.

Time Limitations

All work for the Ph.D. degree, including course work, research, and comprehensive and final examinations, must be completed in not more than seven years from the time of first registration as a matriculated graduate student. Exceptions, as special circumstances may warrant, may be made following a petition from the student to the Dean, supported by the director of the graduate program and approved by the Dean and the Graduate Council.

Combined M.D./Ph.D. Program

Thomas Jefferson University offers a combined M.D./Ph.D. program for students who wish to prepare for a career in academic medicine and medical research. The purpose of the program is to give students a medical education and a theoretical and practical foundation in a biomedical discipline.

Typically, students complete the first two years of the medical school curriculum in Jefferson Medical College, followed by a three year period of full-time study and laboratory research in the College of Graduate Studies. Upon completion of the experimental work required for the Ph.D. thesis, the student returns to Jefferson Medical College to complete the remaining two years of clinical training. For each student, the research component of the M.D./Ph.D. curriculum is carried out under the supervision of a thesis advisor, who is a member of one of the nine Ph.D. programs in the College of Graduate Studies. These programs are:

Biochemistry and Molecular Biology
Cell and Tissue Engineering
Developmental Biology and Teratology
Genetics
Immunology
Microbiology and Molecular Virology
Molecular Pharmacology & Structural Biology
Pathology and Cell Biology
Physiology

During the years of study in the medical college, students receive the full benefit of the Jefferson Clinical Program, which is widely acclaimed for its excellence. The Medical College basic science curriculum includes anatomy, histology, biochemistry, physiology, the neurosciences, pathology, immunology, microbiology, and pharmacology. Students pursuing the combined M.D./Ph.D. degrees will complete these courses in Jefferson Medical College as well as graduate courses in their area of study. Refer to the appropriate Ph.D. program section to see the required graduate courses. The M.D./Ph.D. degrees are customarily awarded at commencement in June of the seventh year.

Jefferson's expanding research is focused on many rapidly developing and contemporary areas of biomedical sciences, with a major emphasis on molecular and cellular biology. There are currently more than over 700 active grants receiving external support in excess of $123 million. Interdepartmental research units, such as the Kimmel Cancer Institute and the Jefferson Institute of Molecular Medicine, are housed in the new $74 million state-of-the-art Bluemle Life

Sciences Building, and serve as focal points to stimulate and nurture multi-disciplinary and collaborative activities to address important biomedical research fronts.

For application procedures, refer to “Combined M.D./Ph.D.” in the section on General Admission Requirements of this catalog.

Ph.D. Program in Biochemistry and Molecular Biology

The curriculum in this program provides students with the training and experience necessary for careers as independent research scientists. The aim of the Ph.D. program is to prepare students to perform and direct research in biochemistry and molecular biology at the cutting edge of modern and future science. The course work and thesis preparation are designed to foster this goal.

The faculty have prepared a core curriculum that integrates basic principles in biochemistry and cellular biology with experimental procedures in cutting edge research. This includes two year-long courses, biochemistry and molecular biology and experimental principles in molecular biology taught by expert faculty from several basic science departments. The student must meet the requirements of the College of Graduate Studies as well as those of the department. Listed below is a series of courses within the department and external to the department, which it is felt, are crucial to a thorough understanding of the field and are, therefore, required of all Ph.D. students in the program.

In the first year the students' focus is to gain sufficient didactic background and during the second year students spend part of their time taking advanced electives and seminar courses. The majority of their time thereafter, is devoted to their thesis research.

The following courses are normally taken during the first year, but must be completed by all students before receiving the Ph.D. degree in Biochemistry and Molecular Biology. Students will also be asked to take additional course work in advanced topics, and they will be expected to attend regularly scheduled journal clubs, seminars by invited speakers, and student seminars.

The Biochemistry and Molecular Biology Program operates in conjunction with the Ph.D. Programs in Genetics, Immunology, Microbiology and Molecular Virology, and Molecular Pharmacology and Structural Biology as part of the Joint Ph.D. Programs. Application can be made either to the Joint Ph.D. Programs or directly to the Biochemistry and Molecular Biology Ph.D. Program; for a description of the operation of the Joint Ph.D. Programs, refer to that section in this Catalog.

Typical areas of research include: Signal transduction and molecular genetics; DNA mutations; RNA; protein degradation pathways; MAP kinases and related pathways; apoptosis; TRAIL signal transduction; receptor actions on the genomes; gene expression; ion channels; intracellular calcium biochemistry; nucleotide repeat disease research, and others.

Program Requirements

Required Courses		Credits
BI 501,511,521,531*	Research Rotation	2 each
BI 515	BI-I Architectural Building Blocks	3
BI 525	BI-II Genetic Information	3

BI 535	BI-III Metabolism	3
BI 612	Dynamics of Macromolecules	3
BI 614	Protein Structure and Function-Structural Biology II	3
BI 710,720,730	Seminar	2 each
BI 910,920,930	Research	variable
GE 611	Introduction to Molecular Genetics	3
GC 640	Research Ethics: The Responsible Conduct of Research	1
PA 510	Concepts in Cell Biology	3

*Research rotations through three laboratories of the student's choice are begun early in the first semester. Optionally, one of the rotations can be taken in the summer before the beginning of the academic year as BI 501. In that instance, the student must matriculate in the summer.

Recommended Electives		Credits
GE 636	Cell Cycle, Growth Factors, Oncogenes	3
PR 636	Experimental Therapeutics	3
BI 624	Extracellular Matrix Proteins and Complex Carbohydrates	2
GE 637	Advanced Human Genetics	3

Graduate Faculty

Professors

GERALD LITWACK, B.A., M.S., Ph.D., University of Wisconsin, 1953: Chairman of the Department of Biochemistry and Molecular Pharmacology; Vice Dean for Research, JMC; Biochemistry and molecular biology of glucocorticoid and mineralocorticoid receptors and associated immunophilins; mode of action and structure of modulator and glucocorticoid-induced programmed cell death.

ARTHUR ALLEN, B.A., M.A., Ph.D., Temple University, 1956: Interrelationships between carbohydrate and lipid metabolism.

JEFFREY L. BENOVIC, B.S., Ph.D., Duke University, 1986; Director of Graduate Program in Molecular Pharmacology and Structural Biology; Molecular and regulatory properties of G protein-coupled receptors; elucidation of the role of G protein-coupled receptor kinases and arrestins in receptor regulation.

TIMOTHY M. BLOCK, B.A., Ph.D., State University New York at Buffalo, 1979: Director for the Jefferson Center for Biomedical Research at Delaware Valley College. Herpes virus latency, molecular mechanisms of herpes virus pathogenesis, and hepatitis B & C virus morphogenesis; analysis and pursuit of antiviral agents, glycovirology; proteomics as a diagnostic tool.

GEORGE C. BRAINARD, B.A., M.A., Ph.D., University of Texas, San Antonio, 1982: Photobiology and neuroendocrine regulation; control of melatonin in humans and animals; effects of light on behavior and mood.

MON-LI CHU, B.S., Ph.D., University of Florida, 1975: The role of extracellular matrix genes in development and disease, with emphasis on cardiovascular and congenital muscular dystrophy.

JOHN L. FARBER, B.A., M.D., University of California, San Francisco, 1966: Biochemical mechanisms of cell injury in ischemia of liver cell necrosis; biochemical toxicology of activated oxygen; chemical carcinogenesis.

BARRY J. GOLDSTEIN, B.S., M.D., Ph.D., University of Rochester School of Medicine, 1982: Insulin receptor signal transduction; protein-tyrosine phosphatases in the regulation of insulin action/resistant disease states.

GERALD B. GRUNWALD, B.A., M.S., Ph.D., University of Wisconsin, 1981: Associate Dean CGS, Director of Graduate Program in Developmental Biology and Teratology; Developmental biology, neuroscience; analysis of cell-cell interactions during development of the nervous system and the eye; studies of regulation of cadherin cell adhesion molecule expression and function in development and disease using biochemical, cell biological, immunological and molecular genetic methods.

THEODORE A. HARE, B.S., Ph.D., Virginia Tech, 1967: Neurotransmitter distribution and function in the mammalian central nervous system.

JAN B. HOEK, Ph.D., University of Amsterdam, 1972: Director of Graduate Program in Pathology and Cell Biology; Cellular aspects of hormonal regulation and its disturbance in response to acute and chronic alcohol treatment; the regulation of cellular calcium homeostasis; the role of calcium in intracellular transduction of hormonal signals; the regulation of phosphoinositide-linked signal transduction system; mitochondrial function and control of cellular energy conservation.

HIDEKO KAJI, B.S., M.S., Ph.D., Purdue University, 1958: Regulatory biochemical mechanisms of macromolecular synthesis; biochemical pharmacology on human anti-retroviral drugs.

GEORGE F. KALF, B.S., M.S., Ph.D., Yale University, 1957: Assistant Dean for Scientific Affairs, JMC; Differentiation of hemopoietic cells; biochemical oncology and carcinogenesis; mechanism of benzene toxicity.

MADHU P. KALIA, M.D., Ph.D., University of Delhi, 1968, M.B.A., Wharton, University of Pennsylvania, 1993: Brain stem mechanisms involved in the control of breathing, cardiovascular control and gastrointestinal function. Pharmacologic aspects used in antiobesity therapy.

JAMES H. KEEN, A.B., Ph.D., Cornell University, 1976: Molecular mechanisms coupling signal transduction with receptor-mediated endocytosis and exocytosis; membrane transport studied by biochemical, molecular biological, and morphological approaches.

JOSE MARTINEZ, B.S., M.D., Universidad Central, Madrid, 1957: Role of fibrin in the differentiation of endothelial cells toward the formation of capillary tubes.

W. EDWARD MERCER, B.S., Ph.D., Pennsylvania State University, 1980: Molecular biology of normal and mutated human tumor suppressor genes and their role in the regulation of cell proliferation; alterations in normal tumor suppressor proteins by DNA tumor virus oncoproteins.

CHARLES S. OWEN, B.S., M.S., Ph.D., University of Pennsylvania, 1964: Fluorescent probes of intracellular pH and calcium ion; intracellular pH homeostasis in tumor cells.

ROGER J. POMERANTZ, B.A., M.D., Johns Hopkins, 1982: HIV latency and molecular pathogenesis; molecular mechanisms of HIV-1 and retroviral transmission; neuropathogenesis of retroviral diseases; transcriptional control of HIV-1 and other retroviruses; intracellular immunization and gene therapeutic techniques to combat HIV-1 infection and novel HIV-1 vaccine approaches.

ANTHONY J. TRIOLO, B.S., M.S., Ph.D., Jefferson Medical College, 1964: Mechanism of benzo(a)pyrene-induced tumors and chemoprotective agents.

ROCKY S. TUAN, B.A., M.A., Ph.D., Rockefeller University, 1977: Cell and molecular biology of skeletal development, growth, and disease; bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; confocal laser imaging of cells and extracellular matrix; animal models of skeletal diseases; molecular, gene-based infection diagnostics. Cellular molecular mechanisms regulating calcium metabolism and calcium-mediated functions during embryonic development, placental calcium transport, gene expression of embryo-specific calcium-binding proteins, limb chondrogenesis and embryonic skeletogenesis.

JOUNI UITTO, M.D., Ph.D., University of Helsinki, 1970: Biochemistry and molecular biology of connective tissue, in relation to cutaneous diseases. Molecular genetics of the cutaneous base membrane zone; regulation of collagen and elastin gene expression, with emphasis on pharmacologic modulation; molecular basis of heritable and acquired connective-tissue diseases, mechanisms of cutaneous aging with development of strategies to prevent reverse age-associated connective-tissue alterations.

WOLFGANG H. VOGEL, B.S., M.S., Ph.D., Institute of Technology, Stuttgart, Germany, 1958: Studies on drug addiction using animals as experimental subjects. Experiments are conducted to investigate the influence of genetic and environmental sectors on the selection and consumption of various cycle active drugs of abuse and to find ways to reduce the craving of the animal for a particular substance with pharmatherapeutic approaches.

SCOTT A. WALDMAN, B.S., Ph.D., M.D., Stanford University, 1987: Molecular mechanisms of signal transduction, with special emphasis on the coupling of peptide ligand-receptor interactions to activation of effector mechanisms.

DAVID A. WENGER, B.S., Ph.D., Temple University School of Medicine, 1968: Biochemical, molecular, pathological and genetic studies on certain lysomal storage diseases; development of improved diagnostic methods; use of animal models for treatment studies; development of vectors for treating Krabbe disease by ex vivo and in vivo gene therapy methods.

ALLEN R. ZEIGER, B.A., Ph.D., Johns Hopkins University, 1967: Opioid receptors and immune function; opiate metabolism.

Emeritus Professors

C. PAUL BIANCHI, B.A., M.S., Ph.D., Rutgers University, 1956: Calcium and the toxicology of biomembranes; pharmacology of muscle; role of calcium in signal transduction, myocardial Mg transport.

Honorary Professors

JAMES J. KOCSIS, B.A., M.S., Ph.D., University of Chicago, 1956: Regulation of metabolism to biological activity of natural products (taurine and prostaglandins) and foreign compounds (CCI4, benzene, chlorinated benzenes and DMSO). Relation of metabolism of salicylates to toxicity.

LEONARD J. LERNER, B.S., B.A., M.S., Ph.D., Rutgers University, 1954: endocrinology and pharmacology of steroid hormones; reproductive system physiology; hormone receptor antagonists; hormonal carcinogenesis.

Adjunct Professors

JOHN E. STAMBAUGH, B.S., M.D., Ph.D., M.D., Jefferson Medical College, 1966, Ph.D. Jefferson Medical College, 1968: Analgesiology.

ROBERT SNYDER, B.S., Ph.D., State University of New York, 1962: Pharmacology, Toxicology.

Associate Professors

YA-MING HOU, B.S., M.A., Ph.D., University of California, Berkeley, 1986: Structural and functional analysis of tRNA mutants; molecular biology of protein-RNA interaction; genetic screening and in vitro mutagenesis, design and creation of novel RNA molecules that function in vivo and in vitro.

MICHAEL P. KING, B.A., Ph.D., California Institute of Technology, 1987: Mammalian mitochondrial biogenesis; molecular genetics of mtDNA mutations in human disease; mitochondrial transformation; post-transcriptional modification of mitochondrial RNAs; motor neuron development.

PETER RONNER, B.S., Ph.D., Swiss Federal Institute of Technology (ETH), 1978: Control of insulin and glucagon release; regulation of ATP-sensitive K-channels and voltage-dependent Ca-channels; role of cellular metabolism in signal transduction.

BARBARA P. SCHICK, B.A., Ph.D., Bryn Mawr College, 1979: Regulation of gene expression and biosynthesis of proteoglycans in hematopoietic and non-hematopoietic cells during cell development; functional aspects of the intracellular and secreted proteoglycans.

CHARLENE J. WILLIAMS, B.A., Ph.D., Rutgers and the University of Medicine and Dentistry of New Jersey, 1983: Genetic linkage analysis of osteo- and inflammatory arthropathies; positional cloning of disease susceptibility genes for osteo- and inflammatory arthropathies; isolation and characterization of genes in normal and diseased cartilage; molecular ecology.

EDWARD P. WINTER, B.A., Ph.D., State University of New York at Stonybrook, 1984: Meiotic development; chromosome structure and function; MAP kinase signaling pathways in yeast.

ALBERT J. WONG, B.A., M.D., Johns Hopkins University, 1983: Genetic alterations in human tumors with emphasis on signal transduction pathways.

KYONGGEUN YOON, B.S., M.S., Ph.D., University of California, Berkeley, 1976: New gene therapy technologies for potential treatment of genetic or acquired skin diseases.

Research Associate Professor

PAMELA A. NORTON, B.A., Ph.D., Tufts University, 1986: Regulation of fibronectin alternative splicing; regulation of fibronectin promoter activity.

Adjunct Associate Professor

DENNIS M. GROSS, B.A., M.Sc., Ph.D., University of California, Los Angeles, 1974: Scientific strategist and operations expert. Drug discovery process and understands which elements of chemistry, biology, molecular biology, clinical research and development must be brought together in a cohesive effort in order to bring new drugs from bench to bedside.

Assistant Professors

CAROL BECK, B.S., Pharm.D., Ph.D., Vanderbilt, 1993: Voltage-gated ion channel pharmacology and physiology; Molecular genetic basis of ion channel diseases; Skeletal muscle voltage-gated chloride channels.

MARTYN K. DARBY, B.Sc., Ph.D., University of Birmingham, United Kingdom, 1981: In vitro evolution, design and structure of novel proteins with unique RNA binding activities. Regulation of RNA polymerase II directed transcription.

MARKUS W. GERMANN, B.S., Ph.D., The University of Calgary, Alberta, Canada, 1989: Structural investigation of nucleic acids and proteins by nuclear magnetic resonance.

NOREEN J. HICKOK, B.S., Ph.D., Brandeis University, 1980: Bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; mechanisms of chondrocyte hypertrophy; regulation of cell proliferation via cytoskeletal/oncogene interactions; confocal laser imaging of cells and extracellular matrix.

ZIWEI HUANG, B.S., Ph.D., California, San Diego, 1993: Structure-function studies of proteins/peptides/peptidomimetics by molecular modeling, peptide synthesis and spectroscopy; structure based drug design.

ERICA S. JOHNSON, B.A., Ph.D., M.I.T., 1992: The ubiquitin-related protein Smt3/SUMO; its conjugation pathway and function in yeast.

DIANE E. MERRY, B.S., M.S., Ph.D., University of Pennsylvania, 1991: Molecular pathogenesis of Kennedy's disease and other polyglutamine expansion diseases; protein folding and misfolding in neurodegenerative disease; mouse models of neurologic disease; role of androgens in motor neuron function and survival.

LAURA STEEL, B.A., Ph.D., Cornell, 1977: Development of early detection biomarkers for hepatocellular carcinoma using proteome analysis.

Research Assistant Professors

EDGAR DAVIDSON, B.Sc., Ph.D., University of Glasgow, 1981: Human mitochondrial genetics; DNA mutations in disease; biochemistry and molecular genetics of respiratory chain enzymes, mitochondrial tRNA synthetases.

NOREEN M. ROBERTSON, B.A., D.M.D., Temple University School of Dentistry, 1990: Defining molecular mechanisms involved in eosinophil apoptosis; elucidation of the role of tumor necrosis family members in airway inflammation in asthma.

Adjunct Assistant Professors

FRANK BARONE, B.A., Ph.D., Syracuse University, 1978: Discoveries in stroke and neuropharmacology.

MARGARET LANDI, B.A., M.S., V.M.D., University of Pennsylvania, 1979: Laboratory animal medicine; study of animal models of human diseases.

Adjunct Clinical Assistant Professor

ROBERT A. MIDDLEBERG, Ph.D., Thomas Jefferson University, 1991: Forensic toxicology; analysis of biological fluids and tissues for the presence of toxicants capable of causing death or affecting human performance; development of analytical methods for toxicants; interactions of science and the law.

Postdoctoral Fellows

ISABELLA ANDRIOLA, Ph.D.

IRINA BELICHENKO, M.D., Ph.D.

CARYN EVILIA, Ph.D.

VENKATADRI KOLLA, Ph.D.

HONGUAN LIANG, Ph.D.

RICHARD LIPMAN, Ph.D.

HSI-CHOU LIU, Ph.D.

JIANYING LUO, Ph.D.

XIAOTIAN MING, Ph.D.

HYEJEONG PARK, Ph.D.

ADAM PERITZ, Ph.D.

NARESH BABU V. SEPURI, Ph.D.

MALANI SETH, Ph.D.

ANDRZEJ STEPLEWSKI, Ph.D.

OLGA VITSEVA, Ph.D.

HUIYI WANG, Ph.D.

JINLING WANG, Ph.D.

LI-JUAN WANG, Ph.D.

KEVIN YU, Ph.D.

CHUN MEI ZHANG, Ph.D.

WEI ZHAO, Ph.D.

MINGSHENG ZHUANG, Ph.D.

Course Descriptions

BI 510 General Biochemistry (Ronner)

Credits 10
Fall

The subject matter of this course includes: (1) properties and structures of biological compounds; (2) enzymology; (3) provision of energy to the cell via the major catabolic pathways; (4) utilization of energy by the cell for macromolecular synthesis and muscle contraction; (5) nutrition; (6) growth, replication and differentiation, including biochemical genetics and developmental biochemistry.

BI 501 Pre-Entry Biochemical Rotation (Litwack)

Credits 2
Summer

Students rotate through faculty laboratories to gain experience with a wide variety of basic laboratory techniques.

BI 511, 521, 531* Research Rotation (Litwack)

Credits 2

Students rotate through faculty laboratories to gain experience with a wide variety of basic laboratory techniques.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525 Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: BI 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

BI 535* Biochemistry and Molecular Biology III - Metabolism (Allen)

Credits 3
Prerequisite: Organic Chemistry
Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

BI 612 Dynamics of Macromolecules (Zeiger)

Credits 3
Prerequisite: BI 515
Fall

The course is intended to familiarize students with the native structures and dynamics of proteins and nucleic acids. Students will present literature articles followed by class discussions. Presenters are to organize the material according to the course goals, condense the material in order to allow discussion and critique it in terms of feasibility of approach, data and further research application. Topics include the thermodynamic stability of proteins and nucleic acids, the roles of kinetics and thermodynamics in protein and nucleic acid folding, predictive schemes for protein folding and an analysis of the loss of stability in mismatched DNA and its biological and biochemical implications.

BI 614 Protein Structure and Function - Structural Biology II (Zeiger)

Credits 3
Prerequisites: BI 515 or BI 550
Spring

The course is intended to introduce students to the high-tech resources and techniques available at Thomas Jefferson University that are useful in studying protein structure and folding. These will include brief presentations of biological data bases and molecular sequence analysis, X-ray crystallography, mass spectrometry, circular dichroism, nuclear magnetic resonance, electron spin resonance, plasmon resonance and molecular modeling. There will be a discussion of some proteins; for example, DNA-binding proteins and membrane-bound proteins that are particularly amenable to study by these techniques.

BI 624 Extracellular Matrix Proteins and Complex Carbohydrates (Schick)

Credits 2
Prerequisites: Biochemistry and some background in physical chemistry
Spring

In depth review and discussion of the structure, function, biosynthesis and cellular interactions of the collagens, glycoproteins and proteoglycans of skin, tendon, cartilage, bone, and other connective tissues. Basic knowledge of the biochemistry of amino acids and carbohydrates will be built upon to describe the structur-

al, molecular, and cell biology of these complex macromolecules and understand their role in development, normal function, and disease. Assigned reading of the literature and student reports. Designed for second-year (and higher) graduate students and postdoctoral fellows who wish to broaden their view.

BI 710, 720, 730* Seminar (Wickstrom)

Credits 2
Each semester/session

The purpose of this course is to provide a forum for the presentation and critical evaluation of recent publications in biology, including the experimental approaches taken and the conclusions drawn. The course consists of a series of oral student presentations to be discussed and evaluated by three attending faculty members following the seminar. Senior students also present their research. As a part of the course, the students are required to attend the department's guest speaker seminars and meet with the speakers to further discuss their work. Assigned reading.

BI 910, 920, 930* Research (Litwack)

Credits variable

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

GE 611* Introduction to Molecular Genetics (Jaynes)

Credits 3
Spring I

The course reviews the principles of classical genetics and underlying molecular mechanisms such as mutation, chromosome segregation recombination and gene conversion. Methods of genetic analysis are introduced in current applications to the study of complex biological processes in mammals in invertebrate model systems. Topics include: genes controlling the yeast cell division cycle; genetic control of cell fate determination in nematodes and fruit flies; gene mapping and genetic manipulation of the mouse.

GE 636 Cell Cycle, Growth Factors and Oncogenes (Calabretta)

Credits 3
Fall

Factors controlling cell growth and mechanisms initiating cell proliferation will be discussed. Foremost will be a consideration of proto-oncogenes and their role in the regulation of cell cycle traverse. Mechanisms of proto-oncogene activation to oncogenes and the role of oncogenes and suppressor genes in uncontrolled cell proliferation and cell transformation will be discussed via a consideration of original papers and student presentations. Assigned reading.

GE 637 Advanced Human Genetics (Huebner)

Credits 3
Spring I

Molecular principles of human diseases with special emphasis on the diseases that are currently under active investigation with the technologies of molecular biology. General review of the principles of human diseases and how the major problems posed by these diseases can be examined experimentally. Among the diseases to be covered will be mutations in hemoglobin genes that produce heritable anemias; mutations in the phenylalanine hydroxylase gene that produce phenylketonuria; mutations in the LDL receptor that produce familial hypercholesterolemia; mutations that produce deficiencies of lysosomal enzymes in syndromes such as Krabbe disease; mutations that produce muscular dystrophy; and mutations that produce cystic fibrosis. In addition, there will be an in-depth discussion of totally mapping the human genome and the potentials for gene therapy. Topics will be covered primarily in a seminar format in which students first review with the faculty original articles from the literature and then have a chance to discuss the articles with a visiting scientist who authored one or more of them. Assigned reading.

GC 640* Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

PA 510* Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

*Required core courses.

Ph.D. Program in Cell and Tissue Engineering

The Graduate Program in Cell and Tissue Engineering (TE) provides an innovative and rigorous research training and education program in the application of contemporary biological and engineering principles to study normal and abnormal tissues and cells for the ultimate goal of designing functional tissue substitutes. The Program emphasizes strengths in molecular biology, cell biology, physiology, biomaterials sciences, and clinical sciences to provide innovative approaches to understanding, imaging, and ameliorating disease states through the use of state-of-the-art tools in biotechnology and informatics. The Ph.D. Graduate Program in Cell and Tissue Engineering provides a multi-disciplinary approach to train and engage students in innovative research areas to address important biomedical problems. The TE Graduate Program prepares the students for careers in academia, as well as in the private sector, including biopharmaceuticals, biotechnology, biomedical materials and devices, and bioinstrumentation.

The training faculty is composed of researchers from many departments within the University who are actively and productively engaged in research directly related to the areas listed above. The student population is comprised of students from widely divergent backgrounds including biology, biochemistry, chemistry, biophysics and bioengineering. Requirements for admission are those stated in the general guidelines of the College of Graduate Studies. Because of the diversity in student background, an advisory committee will meet with each student at the initiation of their career to individually tailor the graduate program to further develop the student's strengths and to train them in areas that are lacking in their background. Didactic coursework is comprised of graduate courses offered in multiple disciplines to provide a sound, fundamental knowledge base for students in the program. In addition, through collaboration with engineering faculty at other schools, research interests and training in biomaterials, biomedical computing, bioinformatics, and biomechanics are also represented. As part of their coursework, students perform research rotations through the laboratories of three participating faculty as a formal first year course; in this course, students acquire sound laboratory skills and begin to gain the breadth of training that is represented by the goals of the program. At the end of the first year, students will choose their research mentor. During the second year, students in the program will demonstrate basic biomedical research knowledge, as well as specialized knowledge in a chosen area of cell and tissue engineering by successful completion of a qualifying examination for admittance to Ph.D. degree candidacy. Finally, by means of thematically organized seminars and journal clubs, the TE Graduate Program, in addition to training scientists, serves to provide an interactive forum for physicians, scientists, and engineers with common research areas.

Some representative areas of faculty research interests include (1) genetic engineering of animal models of human diseases, (2) tissue engineering, (3) biomaterials, (4) cellular and functional bioimaging, (5) cellular bioreactor technology, (6) cellular and molecular phenotyping technologies, and (7) biological/medical information technology.

Program Requirements

Required Courses

		Credits
BI 515,525,535	Biochemistry & Molecular Biology	3 each
PA 510	Cell Biology	3
TE 511,521,531	Tissue Engineering Techniques	2 each
TE 514,524,534	Journal Club	2 each
TE 910,920,930	Tissue Engineering Research	2 each
GC 640	Research Ethics	1
GC 660	Statistical Methods for Data Analysis	2

Additional Courses* that may be Required Depending on Specialization

BI 612	Dynamics of Macromolecules	2
BI 614	Protein Structure and Function	2
AN 510	Human Histology and Embryology	6
AN 520	Human Gross Anatomy	9
DB 615,625,635	Developmental Biology	3 each
GC 535	Intro. to Structural Biology & Bioinformatics	2
GE 611	Molecular Genetics	3
GE 636	Cell Cycle, Growth Factors, and Oncogenes	3
GE 637	Advanced Human Genetics	3
PA 570	Pathologic Aspects of Disease	3
PS 520	Mammalian Physiology	10

Recommended Electives

PS 624	Energy Transduction in Biological Systems	2
PS 613	Muscle Physiology	2
PS 621	Endocrine Physiology	2
PS 623	Renal Physiology	2
PR 530	Fundamentals of Biosafety	1

Graduate Faculty

Professors

GEORGE C. BRAINARD, B.A., M.A., Ph.D., University of Texas-San Antonio, 1982: Photobiology and neuroendocrine regulation; control of melatonin in humans and animals; effects of light on behavior and mood.

MON-LI CHU, B.S., Ph.D., University of Florida, 1975: The role of extracellular matrix genes in development and disease, with emphasis on cardiovascular and congenital muscular dystrophy.

THOMAS B. KNUDSEN, B.S., Ph.D., Thomas Jefferson University, 1981: Developmental biology and teratology; mitochondrial mechanisms of teratogenesis; genomic basis of differential teratogen susceptibility; programmed cell death in the early embryo.

DEVENDRA M. KOCHHAR, B.Sc., M.Sc., Ph.D., University of Florida, 1964: Developmental biology/teratology; molecular events associated with limb dysmorphogenesis and chondrogenesis; biosynthesis of extracellular components such as collagen analyzed as affected by certain genetic mutations; role of retinoid receptors in the embryo.

IRVING M. SHAPIRO, Ph.D., London, 1969: Director of Graduate Program in Cell and Tissue Engineering; Cell and molecular biology of bone and cartilage formation; mechanisms of biological mineralization; analysis of energy metabolism in skeletal cells; mechanisms of apoptosis of chondrocytes and osteoblasts; Effects of microgravity on bone cell function.

J. BRUCE SMITH, B.S., M.D., Bowman Gray School of Medicine, 1965: Role of T cells in the development or perpetuation of osteoarthritis; immunohistochemical studies on synovial tissue from patients with OA.

ROCKY S. TUAN, B.A., M.A., Ph.D., Rockefeller University, 1977: Cell and molecular biology of skeletal development, growth, and disease; bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; confocal laser imaging of cells and extracellular matrix; animal models of skeletal diseases; molecular, gene-based infection diagnostics. Cellular molecular mechanisms regulating calcium metabolism and calcium-mediated functions during embryonic development, placental calcium transport, gene expression of embryo-specific calcium-binding proteins, limb chondrogenesis and embryonic skeletogenesis.

JOUNI UITTO, M.D., Ph.D., University of Helsinki, 1970: Biochemistry and molecular biology of connective tissue, in relation to cutaneous diseases. Molecular genetics of the cutaneous base membrane zone; regulation of collagen and elastin gene expression, with emphasis on pharmacologic modulation; molecular basis of heritable and acquired connective-tissue diseases, mechanisms of cutaneous aging with development of strategies to prevent reverse age-associated connective-tissue alterations

DAVID A. WENGER, B.S., Ph.D., Temple University School of Medicine, 1968: Biochemical, molecular, pathological and genetic studies on certain lysosomal storage diseases; development of improved diagnostic methods; use of animal models for treatment studies; development of vectors for treating Krabbe disease by ex vivo and in vivo gene therapy methods.

ERIC WICKSTROM, B.S., Ph.D., University of California, Berkeley, 1972: Antisense oligonucleotides for cancer therapy; antigenomic oligonucleotides for viral therapy; gene insertion at defined sequences for congenital diseases.

Associate Professors

JEFFREY I. JOSEPH, D.O., Implantable optical blood chemistry sensors; tissue engineering for stable vascular interface; biomaterials; neovascularization; implantable drug delivery systems; artificial endocrine pancreas; implantable cardiovascular sensor.

A. SUE MENKO, B.A., Ph.D., University of Pennsylvania, 1978: The role of integrins in the regulation of cell differentiation; current studies focus on integrin signaling of cell differentiation events, particularly integrin-growth factor receptor coordinated signaling.

CHARLENE J. WILLIAMS, B.A., Ph.D., Rutgers and the University of Medicine and Dentistry of New Jersey, 1983: Genetic linkage analysis of osteo- and inflammatory arthropathies; positional cloning of disease susceptibility genes for osteo- and inflammatory arthropathies; isolation and characterization of genes in normal and diseased cartilage; molecular ecology.

EDWARD P. WINTER, B.A., Ph.D., State University of New York at Stonybrook, 1984: Meiotic development; chromosome structure and function; MAP kinase signaling pathways in yeast.

Research Associate Professor

PAMELA A. NORTON, Ph.D., Tufts University, 1986: Molecular and cellular regulation of the extracellular matrix protein fibronectin during embryonic limb development; mechanisms of transcriptional regulation of extracellular matrix genes in liver and roles in the pathogenesis of chronic hepatitis B virus infection.

Assistant Professors

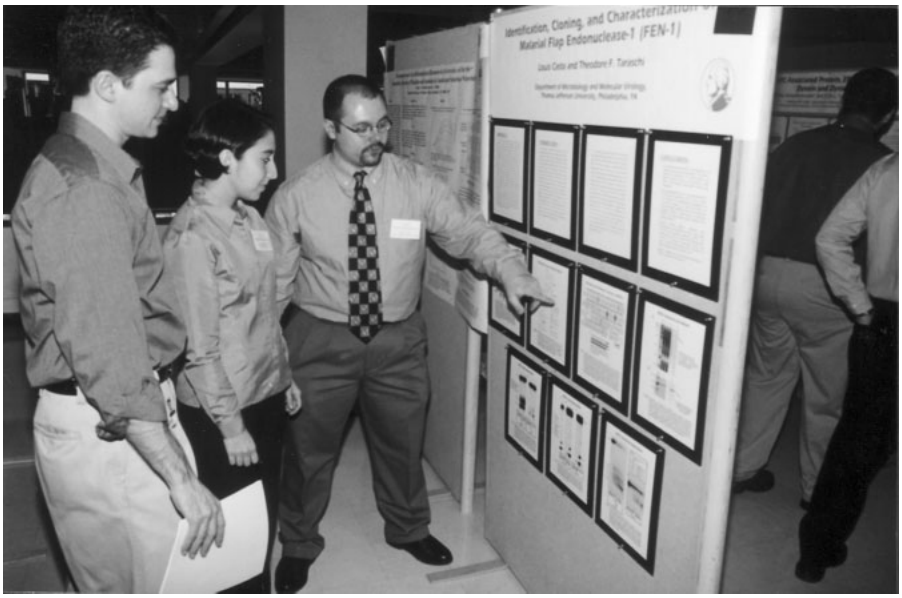
CHRISTOPHER S. ADAMS, Ph.D., Kent State University, 1996: Bone and cartilage cell death; biomechanics; biology of articular cartilage degeneration; physiology of body weight regulation.

ROBERT E. AKINS, JR., Ph.D., University of Pennsylvania, 1992: Cell and molecular biology of mammalian striated muscle; tissue engineering, gene therapy, and surgical implantation for the treatment of muscular diseases; effects of multi-cellular organization on gene expression and component cell phenotype; biosynthetic tissue homologues for in vitro research and pharmacological testing; HSP-32/hemo-oxygenase activity in muscle physiology and signal transduction pathways; bioreactor design and the use of optical methods to assess the development of tissue constructs; advanced electrophoretic methods in clinical diagnostics.

AHMED EL-GHANNAM, Ph.D., University of Pennsylvania, 1995: Engineered scaffolds for cell and drug delivery, resorbable bioactive materials, surface engineering with biological molecules and peptides. Cell-material interaction, tissue integration with implant, bone regeneration, bone cement.

NOREEN J. HICKOK, B.S., Ph.D., Brandeis University, 1981: Bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; mechanisms of chondrocyte hypertrophy; regulation of cell proliferation via cytoskeletal/oncogene interactions; confocal laser imaging of cells and extracellular matrix.

MARLA J. STEINBECK, Ph.D., Iowa State University, 1987: Production of reactive oxygen species (ROS) by inflammatory cells and osteoclasts; mechanism of ROS-mediated bone resorption; elucidation of signaling pathways and transcriptional regulators involved in ROS-mediated differentiation.



Course Descriptions

TE 511, 521, 531* Tissue Engineering Techniques I, II, III (Hickok)

Credits 2 each
Fall, Spring I, Spring II

This is a three semester course that examines current techniques and progress in tissue engineering. The first two trimesters examine the parameters that allow the organization and the function of the tissue and of the cell, as well as particular requirements for blood flow, hormonal regulation, and mechanical requirements. Examination of successful biomimetics and biomaterials, and the particular functions engineered within them that allow successful implantation/transplantation. The third trimester introduces students to contemporary technologies in optical imaging of biological structures. The following topics and technologies are covered: (1) principles and applications of light and electron microscopy, (2) confocal laser scanning microscopy, (3) atomic force scanning microscopy, and (4) fluorimetric ion imaging. This third trimester takes the student into the laboratory to gain a more practical understanding of these technologies.

TE 514, 524, 534* Journal Club/Seminar (Steinbeck)

Credits 2
Fall, Spring I, Spring II

The Journal Club/Seminar course will serve three purposes. Firstly, it will be a forum for students to critically evaluate current literature and present their critiques to their peers. Secondly, through interaction with seminar speakers, it will introduce students to investigators at the forefront of research into Cell and Tissue Engineering and Biotechnology, and through interaction with the speakers, put the student's work into the context of the field. Finally, it will teach students the necessary organizational and speaking skills to successfully present their work to peers knowledgeable in their areas.

TE 910, 920, 930* Research (Shapiro)

Credits variable
Fall, Spring I, Spring II

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525* Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: BI 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

BI 535* Biochemistry and Molecular Biology III - Metabolism (Allen)

Credits 3
Prerequisite: Organic Chemistry
Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

BI 612 Dynamics of Macromolecules (Zeiger)

Credits 3
Prerequisite: BI 515
Fall

The course is intended to familiarize students with the native structures and dynamics of proteins and nucleic acids. Students will present literature articles followed by class discussions. Presenters are to organize the material according to the course goals, condense the material in order to allow discussion and critique it in terms of feasibility of approach, data and further research application. Topics include the thermodynamic stability of proteins and nucleic acids, the roles of kinetics and thermodynamics in protein and nucleic acid folding, predictive schemes for protein folding and an analysis of the loss of stability in mismatched DNA and its biological and biochemical implications.

BI 614 Protein Structure and Function (Zeiger)

Credits 3
Prerequisite: BI 515 or BI 550
Spring

The course is intended to introduce students to the high-tech resources and techniques available at Thomas Jefferson University that are useful in studying protein structure and folding. These will include brief presentations of biological data bases and molecular sequence analysis, X-ray crystallography, mass spectrometry, circular dichroism, nuclear magnetic resonance, electron spin resonance, plasmon resonance and molecular modeling. There will be a discussion of some proteins; for example, DNA-binding proteins and membrane-bound proteins that are particularly amenable to study by these techniques.

PA 510* Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

AN 510 Human Histology and Embryology (Jensh)

Credits 6
Follows JMC schedule

Lecture and laboratory. This course deals with the normal microscopic structure and development of the human body. Special emphasis is given to ultrastructure and to morphological changes due to functional states.

GC 535 Introduction to Genomics and Bioinformatics (Williams, Pellini)

Credits 2
Spring I

This course introduces the principles of medical genetics to graduate students who require a working knowledge of modern molecular genetics. The first half of the course will provide students with a background for understanding the genetics of disease. Topics to be reviewed will include: the chromosomal basis of heredity; the structure and function of genes and chromosomes; and the patterns of single and multifactorial inheritance. The second half of the course will acquaint students with the newly emerging fields of study as a result of sequencing projects (Bioinformatics, Proteomics and Pharmacogenomics) and explore the potential career opportunities in these areas. Several presentations will also be devoted to accessing DNA and protein analysis programs through the internet, so that the student can gain hands-on experience navigating web-based information tools and extracting information from the growing number of databases available to biomedical researchers.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

DB 615 Developmental Biology and Teratology I: Embryology (McHugh)

Credits 3
Fall

Embryogenesis encompasses development of an organism from fertilization to birth. DB 615 will describe the fundamental and historical concepts of morphogenesis and cell differentiation as they pertain to the early embryo, body axis formation, and development and maturation of the major organ systems, including the placenta. Emphasis will be placed on comprehensive descriptions of developmental systems.

DB 625 Developmental Biology and Teratology II: Mechanisms of Development (Grunwald)

Credits 3
Prerequisite: DB 615 or equivalent
Spring I

This course will examine specific developmental events in detail, emphasizing contemporary concepts in cellular regulation, growth and pattern formation, differential gene expression, and cell death. Lectures and problem-based discussion groups will explore the rationale behind experimental design as it pertains to investigating principal mechanisms directing normal embryogenesis.

DB 635 Developmental Biology and Teratology III: Mechanisms of Teratogenesis (Knudsen)

Credits 3
Prerequisites: DB 615, 625 or permission of the instructor
Spring II

Teratology is the study of birth defects and their causes and includes investigations pertaining to both structural and functional abnormalities. About 2-3% of live-born infants have detectable congenital malformations at birth; the incidence often doubles by the end of the first year of life due to the discovery of abnormalities which were indiscernible at birth. These figures still do not account for intrauterine growth retardation and prenatal deaths. Like carcinogenesis, teratogenesis involves complex interactions between the genome and environment of an individual. DB 635 will explore these interactions as they pertain to the pregnant mother and fetus, integrating information regarding causal signals of abnormal development, the transduction of these signals into a teratogenic lesion, and the genes which are likely to be determining factors in abnormal embryonic development. It will also encompass a unit on applied teratology from the perspective of pharmaceutical testing to determine how human teratogens are discovered.

*Required core courses.

Ph.D. Program in Developmental Biology and Teratology

The objective of the Graduate Program in Developmental Biology and Teratology is the training of individuals toward the development of the intellectual and technical skills required for an independent career in research and education. Recruitment and admissions for the Developmental Biology and Teratology program and the program in Pathology and Cell Biology are administered by the Department of Pathology, Anatomy, and Cell Biology.

The application of modern cell and molecular biological methods to studies of embryonic development have led to exciting advances in our understanding of developmental mechanisms. Therefore, the program has a core curriculum of courses in developmental biology, cell biology, biochemistry, and molecular biology. These courses provide the student with a thorough background of the major issues in these areas, as well as the modern experimental methods by which questions in these areas are investigated. As a trainee in a program faculty member's laboratory, a student will work with his/her chosen faculty mentor to pursue a scholarly research project.

The Graduate Program in Developmental Biology and Teratology has its focus on studies of cellular and molecular mechanisms of embryonic development. An interdepartmental NIH-funded Training Program in Cellular and Molecular Determinants of Birth Defects, which operates as a component of the Developmental Biology and Teratology Graduate Program, provides the opportunity for in-depth studies of the fundamental mechanisms of abnormal embryonic development. Students will learn how modern biotechnology is applied in academia, industry, and government to address these problems and elucidate the causes of, and means for prevention of, human birth defects. In addition, the Developmental Biology and Teratology program provides the opportunity for training and teaching experience in the traditional anatomical disciplines of histology, gross anatomy, and neuroanatomy for interested students.

Training in the technical and intellectual skills which will permit the graduating student to continue on towards an independent research career begins in the first year with a series of rotation periods in the laboratories of program faculty, whose names and research interests are listed below. This provides the student with exposure to a variety of scientific interests and experimental methods, following which the student selects a research advisor in whose laboratory the thesis research will be conducted. Prospective students with more focused objectives, especially those who are interested in working with a specific faculty member, are encouraged to communicate with individual faculty members during the application process to ensure their availability as a mentor.

Typical areas of research within the program span the fields of developmental biology, cell biology, molecular biology, biochemistry, neurobiology, and teratology. Specific areas of faculty research include developmental toxicology, immunology, neurobiology, membrane biology, genetics, cyclic nucleotides, lipids and transmembrane signaling, neuroanatomy, growth factors, teratologic effects of retinoids, limb development and chondrogenesis, cell-cell and cell-substrate adhesion, cancer, myogenesis, development of the retina, cerebellum and lens, regulation of gene expression.

Program Requirements

Required Courses

		Credits
DB 615	Developmental Biology and Teratology I: Embryology	3
DB 625	Developmental Biology and Teratology II: Mechanisms of Development	3
DB 635	Developmental Biology and Teratology III: Mechanisms of Teratogenesis	3
DB 610,620,630	Research Rotation I, II, III	1 each
DB 616,626,636	Current Topics in Developmental Biology I, II, III	1 each
DB 710,720,730	Seminar (Each year)	1 each
DB 910,920,930	Research (Each year)	variable
BI 515,525	Biochemistry and Molecular Biology I & II	3 each
GE 637	Advanced Human Genetics	3
GC 640	Research Ethics: The Responsible Conduct of Research	1
GC 660	Statistical Methods for Data Analysis	2
PA 510	Concepts in Cell Biology	3
PR 630	General Toxicology	3

Graduate Faculty

Professors

DAVID E. BIRK, Ph.D., Wayne State, 1981: Developmental biology of extracellular matrix assembly in tendons and the cornea; mechanisms regulating collagen fibrillogenesis and tissue-specific fiber formation.

RONALD A. COSS, B.A., Ph.D., University of Colorado, 1974: Cell biology: radiation biology; cell cycle, mitosis, and cytokinesis; nuclear matrix and cytomatrix; heat shock of cells in culture; determination of critical cellular structures whose modification by heat shock results in cell death.

LEONARD M. EISENMAN, B.A., M.A., Ph.D., Duke University, 1974: Neuroscience; anatomical, developmental and functional studies of the organization of the cerebellum; the normal and abnormal development of this structure analyzed with the use of rodents and neurologically mutant mice; the special emphasis given to the development of the topographic and synaptic organization of afferent systems to the cerebellum.

GERALD B. GRUNWALD, B.A., M.S., Ph.D., University of Wisconsin, 1981, Associate Dean CGS, Director of Graduate Program in Developmental Biology and Teratology; Developmental biology, neuroscience; analysis of cell-cell interactions during development of the nervous system and the eye; studies of regulation of cadherin cell adhesion molecule expression and function in development and disease using biochemical, cell biological, immunological and molecular genetic methods.

JAN B. HOEK, Ph.D., University of Amsterdam, 1972: Director of Graduate Program in Pathology and Cell Biology; Cellular aspects of hormonal regulation and its disturbance in response to acute and chronic alcohol treatment; the regulation of cellular calcium homeostasis; the role of calcium in intracellular transduction of hormonal signals; the regulation of phosphoinositide-linked signal transduction system; mitochondrial function and control of cellular energy conservation.

LORRAINE IACOVITTI, Ph.D., Cornell, 1979. Developmental biology and neuroscience; mechanisms of neuronal cell differentiation and development of neurotransmitter class; application of immortalized stem cells to treat neurodegenrative diseases such as Parkinson's and Alzheimer's.

RONALD P. JENSH, B.A., M.A., Ph.D., Jefferson Medical College, 1966: Teratology; postnatal effects of prenatal exposure; studies of low level exposure to X-irradiation, ultrasound, and exposure to vitamin A and their effects on postnatal growth; reflex acquisition; physiologic development and learning in neonates and adult offspring.

SURESH K. JOSEPH, B.Sc., Ph.D., University of Bristol, 1978: Structure, function, and regulation of the inositol trisphosphate receptor (IP3R); biosynthesis and assembly of IP3R homo- and heterooligomers; mechanisms of proteasomal and lysosomal degradation of IP3R. Alcohol research; calcium metabolism; cell biology; membrane biology, receptors and signal transduction.

HIDEKO KAJI, B.S., M.S., Ph.D., Purdue University, 1958: Regulatory biochemical mechanisms of macromolecular synthesis; biochemical pharmacology on human anti-retroviral drugs.

THOMAS B. KNUDSEN, B.S., Ph.D., Thomas Jefferson University, 1981: Developmental biology and teratology; mitochondrial mechanisms of teratogenesis; genomic basis of differential teratogen susceptibility; programmed cell death in the early embryo.

DEVENDRA M. KOCHHAR, B.Sc., M.Sc., Ph.D., University of Florida, 1964: Developmental biology/teratology; molecular events associated with limb dysmorphogenesis and chondrogenesis; biosynthesis of extracellular components such as collagen analyzed as affected by certain genetic mutations; role of retinoid receptors in the embryo.

BARBARA P. SCHICK, B.A., Ph.D., Bryn Mawr College, 1979: Regulation of gene expression and biosynthesis of proteoglycans in hematopoietic and non-hematopoietic cells during cell development; functional aspects of the intracellular and secreted proteoglycans.

RICHARD R. SCHMIDT, B.A., Ph.D., Medical College of Wisconsin, 1975: Developmental immunology and developmental toxicity of the mammalian immune system; the arachidonic acid cascade and its relationship to in vitro growth and differentiation of the fetal murine thymus.

DAVID S. STRAYER, M.D., Ph.D., Chicago. Genetic determinants of viral virulence and virus interaction with infected cells; regulation of pulmonary surfactant secretion and of surfactant protein gene expression; role of epidermal growth factor and like cytokines in oncogenesis; regulation of cell division.

ROCKY S. TUAN, B.A., M.A., Ph.D., Rockefeller University, 1977: Cell and molecular biology of skeletal development, growth, and disease; bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; confocal laser imaging of cells and extracellular matrix; animal models of skeletal diseases; molecular, gene-based infection diagnostics. Cellular molecular mechanisms regulating calcium metabolism and calcium-mediated functions during embryonic development, placental calcium transport, gene expression of embryo-specific calcium-binding proteins, limb chondrogenesis and embryonic skeletogenesis.

JOUNI UITTO, M.D., Ph.D., University of Helsinki, 1970: Biochemistry and molecular biology of connective tissue, in relation to cutaneous diseases. Molecular genetics of the cutaneous base membrane zone; regulation of collagen and elastin gene expression, with emphasis on pharmacologic modulation; molecular basis of heritable and acquired connective-tissue diseases, mechanisms of cutaneous aging with development of strategies to prevent reverse age-associated connective-tissue alterations.

Associate Professors

MANUEL L. COVARRUBIAS, M.Sc., M.D., Ph.D., National University of Mexico, 1977; Ph.D., National University of Mexico, 1980: Molecular mechanisms that regulate the function of cloned voltage-sensitive potassium channels; recombinant DNA techniques (e.g. in vitro mutagenesis) and electrophysiological recording (e.g. patch-clamp recording) used to study the structure-function relation; the action of protein kinases, regulation of channel gating, and the action of ethanol and general anesthetics.

BRUCE A. FENDERSON, B.S., Ph.D., Johns Hopkins University, 1980: Mechanisms of morphogenesis and malignancy; role of cell surface carbohydrates in developmental processes and differentiation; the glycolipids of human germ cell tumors and the role of hyaluronan in regulating cell migration.

KIRK M. MCHUGH, B.S., Ph.D., University of Cincinnati College of Medicine, 1986: Molecular biology; molecular genetics of isoactin gene expression during mammalian development; development of gastrointestinal smooth muscle utilizing a variety of molecular and cellular techniques.

A. SUE MENKO, B.A., Ph.D., University of Pennsylvania, 1978: The role of integrins in the regulation of cell differentiation; current studies focus on integrin signaling of cell differentiation events, particularly integrin-growth factor receptor coordinated signaling.

NANCY J. PHILIP, Ph.D., Wayne State, 1981: Cellular and developmental biology; developmental regulation of transport proteins and metabolism in the retina and retinal pigment epithelium.

ELIZABETH J. VAN BOCKSTAELE, Ph.D., NYU, 1991: Neuroscience; neuroanatomy and neurophysiology of catecholaminergic brain nuclei involved in drug addiction and withdrawal mechanisms; mechanisms of stress and control of autonomic processes.

Research Associate Professor

PAMELA A. NORTON, Ph.D., Tufts University, 1986: Molecular and cellular regulation of the extracellular matrix protein fibronectin during embryonic limb development; mechanisms of transcriptional regulation of extracellular matrix genes in liver and roles in the pathogenesis of chronic hepatitis B virus infection.

Assistant Professors

JAMES B. JAYNES, B.S., Ph.D., University of Washington (Seattle), 1987: Developmental biology and genetics; transcription factor interactions during development of Drosophila; genetic control of pattern formation.

ALEXANDER MAZO, Ph.D., Institute of Molecular Biology, Academy of the Sciences of the USSR, 1986: Drosophila developmental genetics; regulation of homeotic genes.

JOY MULHOLLAND, B.A., M.S., A.M., Ph.D., Harvard University, 1983: Steroid hormone regulation of gene expression in the female reproductive tract; molecular causes of infertility, induction of uterine adenocarcinoma, regulation of epithelial cell polarity, biological effects of microgravity.

Course Descriptions

AN 510 Human Histology and Embryology (Jensh)

Credits 6
Follows JMC schedule

Lecture and laboratory. This course deals with the normal microscopic structure and development of the human body. Special emphasis is given to ultrastructure and to morphological changes due to functional states.

AN 520 Human Gross Anatomy (Schmidt)

Credits 9
Follows JMC schedule

Lecture and laboratory. The gross structure of the human body, adult and neonatal, is considered by dissection, lectures and conferences, with consideration given to functional adaptation of gross morphology.

AN 530 Neuroanatomy (Grunwald)

Credits 4
Follows JMC schedule

Lecture and laboratory. The organization of the human nervous system is considered from a combination of gross anatomical, histological, and functional viewpoints. Topics covered include regional neuroanatomy of the spinal cord and brain as well as the organization of various motor and sensory systems.

DB 610, 620, 630* Research Rotation I, II, III (Grunwald)

Credits 1 each
Fall, Spring I, Spring II

Students select a series of program faculty research laboratories where they will become familiar with various scientific questions being investigated, as well as the methodologies used to address these questions. This is the principle mechanism through which students and faculty work together to explore the potential partnership that will evolve into a student-mentor relationship and the development of a scholarly thesis research project.

DB 615* Developmental Biology and Teratology I: Embryology (McHugh)

Credits 3
Fall

Embryogenesis encompasses development of an organism from fertilization to birth. DB 615 will describe the fundamental and historical concepts of morphogenesis and cell differentiation as they pertain to the early embryo, body axis formation, and development and maturation of the major organ systems, including the placenta. Emphasis will be placed on comprehensive descriptions of developmental systems.

DB 625* Developmental Biology and Teratology II: Mechanisms of Development (Grunwald)

Credits 3
Prerequisite: DB 615 or equivalent
Spring I

This course will examine specific developmental events in detail, emphasizing contemporary concepts in cellular regulation, growth and pattern formation, differential gene expression, and cell death. Lectures and problem-based discussion groups will explore the rationale behind experimental design as it pertains to investigating principal mechanisms directing normal embryogenesis.

DB 635* Developmental Biology and Teratology III: Mechanisms of Teratogenesis (Knudsen)

Credits 3
Prerequisites: DB 615, 625 or permission of the instructor
Spring II

Teratology is the study of birth defects and their causes and includes investigations pertaining to both structural and functional abnormalities. About 2-3% of live-born infants have detectable congenital malformations at birth; the incidence often doubles by the end of the first year of life due to the discovery of abnormalities which were indiscernible at birth. These figures still do not account for intrauterine growth retardation and prenatal deaths. Like carcinogenesis, teratogenesis involves complex interactions between the genome and environment of an individual. DB 635 will explore these interactions as they pertain to the pregnant mother and fetus, integrating information regarding causal signals of abnormal development, the transduction of these signals into a teratogenic lesion, and the genes which are likely to be determining factors in abnormal embryonic development. It will also encompass a unit on applied teratology from the perspective of pharmaceutical testing to determine how human teratogens are discovered.

DB 616, 626, 636 Current Topics in Developmental Biology I, II, III (Grunwald)

Credits 1 each
Fall, Spring I, Spring II

Meetings of faculty and students organized as a “journal club” to discuss selected current literature.

DB 705 Developmental Neurobiology (Grunwald)

Credits 3
Prerequisite: AN 530 or equivalent
Fall

Survey course of major investigative lines that developmental neurobiologists follow in order to study how the nervous system develops. Topics include: neural tube formation; neural crest migration; proliferation and migration of neurons and glia; neuronal determination; cell death; synaptogenesis.

DB 710, 720, 730* Seminar (Van Bockstaele)

Credits 1 each
Fall, Spring I, Spring II

Required of all graduate students in Developmental Biology and Teratology; students and faculty report on recent developments in areas of research interest and on departmental research projects. Visiting scientists are also invited to present seminars.

DB 715 Selected Topics in Neurosciences (Van Bockstaele)

Credits 2

Lectures and discussion groups dealing with selected literature topics of current interest.

DB 745 Developmental Toxicology (Knudsen)

Credits 3
Prerequisite: PR 630 or equivalent

In-depth analysis of endpoint assays for measuring adverse effects of environmental agents on developmental parameters. Selected readings from contemporary scientific literature will serve as didactic and colloquial foci for discussions. Topics include: effects on male and female reproduction and the conceptus; multigenerational effects; thresholds of effect; quantitative risk estimation; generic application of safety factors; impact of regulatory actions in the workplace.

DB 910, 920, 930* Research (Grunwald)

Credits variable
Fall, Spring I, Spring II

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525* Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: BI 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

GC 700 Introduction to Neuroscience (Grunwald, Horn)

Credits 3
Fall

Introduction to Neuroscience is a graduate lecture/seminar survey course which is designed to introduce students to basic concepts and experimental approaches to issues in the neurosciences. The course is divided into two integrated sections focusing on 1) Neurophysiology and Synaptic Transmission and 2) Neuroanatomy and Systems. An interdepartmental team of faculty will lead students through these topics with a series of lectures and discussions based upon assigned text readings and current journal articles.

GE 637* Advanced Human Genetics (Huebner)

Credits 3
Spring I

Molecular principles of human diseases with special emphasis on the diseases that are currently under active investigation with the technologies of molecular biology. General review of the principles of human diseases and how the major problems posed by these diseases can be examined experimentally. Among the diseases to be covered will be mutations in hemoglobin genes that produce heritable anemias; mutations in the phenylalanine hydroxylase gene that produce phenylketonuria; mutations in the LDL receptor that produce familial hypercholesterolemia; mutations that produce deficiencies of lysosomal enzymes in syndromes such as Krabbe disease; mutations that produce muscular dystrophy; and mutations that produce cystic fibrosis. In addition there will be an in-depth discussion of totally mapping the human genome and the potentials for gene therapy. Topics will be covered primarily in a seminar format in which students first review with the faculty original articles from the literature and then have a chance to discuss the articles with a visiting scientist who authored one or more of them. Assigned reading.

PA 510* Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

PR 630 General Toxicology (Middleberg)

Credits 3
Summer

This course will introduce students to the principles and practices of Toxicology. Emphasis will be given to the comprehensiveness of toxicology as opposed to individual academic interests. While introductory courses in biochemistry, physiology, anatomy, and pharmacology would be helpful, they are not necessary since each topic will be covered as an introduction to the subject matter.

* Required core courses.

Ph.D. Program in Genetics

The goal of this program, one component of the Joint Ph.D. Programs (refer to that section in this Catalog), is to provide aspiring students with the training and experience necessary for them to launch careers as independent scientific investigators and scholars in the field of molecular genetics. Application can be made either to the Joint Ph.D. Programs or directly to the Genetics Ph.D. Program. The program provides sufficient flexibility so that graduating students can pursue research careers in either an academic or industrial setting. Students take a common core course curriculum during the first year consisting of courses in the fundamental aspects of biochemistry, molecular biology, genetics, and cell biology. Course work during the first year is supplemented by three laboratory rotations in which students learn advanced laboratory techniques and the principles of sound experimental methods.

At the end of the first year, the student must select a faculty supervisor for his or her thesis research. During the second year specialized courses are taken which focus on different aspects of the genetics of cancer and human diseases, including the molecular genetics of growth control, oncogene activation, tumor suppression, regulation of gene expression, receptor-ligand interactions, and signal transduction. Students may also take additional courses in advanced special topics and are required to attend regularly scheduled faculty and student seminars in molecular genetics and seminars given by invited speakers.

Typical areas of research include: functional genomics, genetics of cancer susceptibility, the molecular genetic analysis of the normal human genome, cytogenetics of aneuploidy syndromes, genetics of the immune system, molecular genetics of animal models of human disease, molecular genetics of hematopoietic neoplasias and solid tumors, genetic analysis of G1-phase and molecular mechanisms of altered growth regulation by oncogenes and tumor suppressor genes, transcriptional regulation and the control of gene expression, and mechanisms of ionizing and nonionizing radiation damage to cells.

Program Requirements

Required Courses		Credits
GE 511,521,531	Experimental Methods I, II, III	3 each
GE 611	Introduction to Molecular Genetics, Part I	3
GE 612	Introduction to Molecular Genetics, Part II	3
GE 636	Cell Cycle, Growth Factors, Oncogenes	3
GE 637	Advanced Human Genetics	3
GE 652	Molecular Basis of Cancer	2
GE 710,720,730	Seminar	1 each
GE 910,920,930	Research	variable
BI 515,525	Biochemistry and Molecular Biology I, II	3 each
GC 640	Research Ethics: The Responsible Conduct of Research	1
PA 510	Concepts in Cell Biology	3

Recommended Elective Courses		Credits
GE 610	Transcriptional Regulation	2
GC 660	Statistical Methods for Data Analysis	2
IM 505	Fundamentals of Immunology	4
MI 531	Medical Virology	2

Graduate Faculty

Professors

DAVID ABRAHAM, B.S., M.S., Ph.D., University of Pennsylvania, 1983:, Parasite immunology. Role of eosinophils in innate and adaptive immunity to nematode parasite infections, vaccine development against *Onchocerca volvulus,* mechanism of immune control of infections and disease caused by *Strongyloides stercoralis;* chemotherapy of leishmaniasis.

EMAD S. ALNEMRI, B.S., M.S., Ph.D., Temple University, 1991: Molecular mechanisms of programmed cell death (apoptosis); signal transduction by death receptors in apoptosis and cancer; intracellular apoptosis regulating complexes.

RENATO BASERGA, M.D., University of Milan, 1949: Genetic analysis of G1-phase and control of cell proliferation; growth factors and their receptors; apoptosis; anticancer therapy.

JEFFREY L. BENOVIC, B.S., Ph.D., Duke University, 1986; Director of Graduate Program in Molecular Pharmacology and Structural Biology; Molecular and regulatory properties of G protein-coupled receptors; elucidation of the role of G protein-coupled receptor kinases and arrestins in receptor regulation.

TIMOTHY M. BLOCK, B.A., Ph.D., State University New York at Buffalo, 1979: Director for the Jefferson Center for Biomedical Research at Delaware Valley College. Herpes virus latency, molecular mechanisms of herpes virus pathogenesis, and hepatitis B & C virus morphogenesis; analysis and pursuit of antiviral agents, glycovirology; proteomics as a diagnostic tool.

BRUCE M. BOMAN, B.A., M.S., M.D., University of Minnesota Medical School 1976; Ph.D., Mayo Graduate School of Medicine, 1982: Colon cancer genetics; integration of molecular testing into diagnosis and management of colorectal cancer; mechanisms of action of the encoded product of the colon cancer susceptibility gene, adenomatous polyposis coli (APC).

BRUNO CALABRETTA, B.S., M.D., Ph.D., University of Modena, 1977; Ph.D., University of Rome, 1987: Molecular biology of normal and leukemic hematopoiesis. Cancer immunology; hematopoiesis and the molecular basis of growth regulation of lymphocytes and leukemic cells; role of the nuclear proto-oncogene c-myb in T-lymphocyte proliferation.

CARLO M. CROCE, M.D., University of Rome, Italy, 1969: Chairman of the Department of Microbiology and Immunology, Director of the Kimmel Cancer Center: Cancer immunology; molecular basis of B- and T-cell neoplasms; role of chromosomal translocations in hematopoietic malignancies; mechanism of gene rearrangement in B and T cells.

PETER J. CURTIS, B.Sc., Ph.D., Glasgow University, 1965: Genetically engineered antibodies for targeted gene therapy applied to immunotherapy for cancer.

RICHARD A. FISHEL, B.S., Ph.D., University of California, Irvine, 1980: The mechanisms and regulation of DNA repair and recombination in human cells; the role of DNA repair in tumorigenesis with emphasis on human mutator genes.

KAY HUEBNER, B.A., Ph.D., University of Pennsylvania, 1974: Human genomic mapping and isolation and characterization of tumor suppressor genes and gene products.

JAMES H. KEEN, A.B., Ph.D., Cornell University, 1976: Molecular mechanisms coupling signal transduction with receptor-mediated endocytosis and exocytosis; membrane transport studied by biochemical, molecular biological, and morphological approaches.

ROBERT KORNGOLD, B.A., M.S., Ph.D., University of Pennsylvania, 1979: Director of Graduate Program in Immunology: Transplantation, autoimmunity, and T-cell immunobiology; problems related to bone marrow transplantation, including graft-versus-host disease (GVHD), graft failure, and graft-versus-leukemia responses; the T-cell response to minor histocompatibility antigens; development, mechanism, and therapeutic inhibitory effects of structure-base designed peptides.

GERALD LITWACK, B.A., M.S., Ph.D., University of Wisconsin, 1953: Chairman of the Department of Biochemistry and Molecular Pharmacology; Vice Dean for Research, JMC; Biochemistry and molecular biology of glucocorticoid and mineralocorticoid receptors and associated immunophilins; mode of action and structure of modulator and glucocorticoid-induced programmed cell death.

W. EDWARD MERCER, B.S., Ph.D., Pennsylvania State University, 1980: Molecular biology of normal and mutated human tumor suppressor genes and their role in the regulation of cell proliferation; alterations in normal tumor suppressor proteins by DNA tumor virus oncoproteins.

BICE PERUSSIA, M.D., University of Milano, Italy, 1974: Cellular immunology, with focus on innate immunity; natural killer cells, their biology, interaction with other hematopoietic cells, and differentiation; function and structure of relevant receptors; molecular mechanisms of lymphocyte activation and signal transduction; cytokines and their role in regulating immune responses.

PHILIP N. TSICHLIS, M.D., University of Athens Medical School, 1968: Genetics of retrovirus-induced rodent lymphomas; signal transduction in normal and neoplastic cells; apoptosis and the regulation of the cell cycle.

ROCKY S. TUAN, B.A., M.A., Ph.D., Rockefeller University, 1977: Cell and molecular biology of skeletal development, growth, and disease; bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; confocal laser imaging of cells and extracellular matrix; animal models of skeletal diseases; molecular, gene-based infection diagnostics. Cellular molecular mechanisms regulating calcium metabolism and calcium-mediated functions during embryonic development, placental calcium transport, gene expression of embryo-specific calcium-binding proteins, limb chondrogenesis and embryonic skeletogenesis.

JOUNI UITTO, M.D., Ph.D., University of Helsinki, 1970: Biochemistry and molecular biology of connective tissue, in relation to cutaneous diseases. Molecular genetics of the cutaneous base membrane zone; regulation of collagen and elastin gene expression, with emphasis on pharmacologic modulation; molecular basis of heritable and acquired connective-tissue diseases, mechanisms of cutaneous aging with development of strategies to prevent reverse age-associated connective-tissue alterations.

Associate Professors

CHARLES BRENNER, B.A., Ph.D., Stanford University, 1993: Functions of the histidine triad proteins using X-ray crystallography, enzymology, and yeast genetics.

ARTHUR M. BUCHBERG, B.S., Ph.D., State University of New York at Buffalo, 1983: Director of Graduate Program in Genetics; (1.) Molecular biology and genetics of myeloid leukemogenesis, identification of genetic modifiers involved in cancer. (2.) Immunogenetics: steps involved in murine myeloid and B-cell leukemogenesis, with emphasis on the identification and characterization of novel proto-oncogenes; creation of a molecular genetic map of the mouse in order to identify candidate genes for classical mouse mutations, regions of homology between the mouse and human genomes, and mouse models of human disease. (3.) Mouse genetics and virology; identifying the steps involved in MuLV-induced myeloid and B cell leukemia; examining the components of MuLV involved in tissue tropism and disease.

PETER J. DONOVAN, B.S., Ph.D., University College London, 1981: Molecular genetics of development; role of growth factors and receptors; cell-cycle regulation in development and gametogenesis; pluripotent stem cells.

GARRET C. DUBOIS, B.A., Ph.D., Pennsylvania State University, 1973: Director of Protein Chemistry Laboratory: Structural and functional characterization of cellular and viral proteins controlling regulation and replication of the Human Immunodeficiency Virus (HIV); structural and functional analysis of proteins instrumental in human acute and chronic leukemias.

ANTONIO GIORDANO, M.D., Naples, 1986; Ph.D., Trieste, 1990: The roles of the retinoblastoma tumor suppressor gene family cyclins, cyclin-dependent kinases and Cdk inhibitors in cell cycle control and cancer.

YA-MING HOU, B.S., M.A., Ph.D., University of California, Berkeley, 1986: Structural and functional analysis of tRNA mutants; molecular biology of protein-RNA interaction; genetic screening and in vitro mutagenesis, design and creation of novel RNA molecules that function in vivo and in vitro.

ALEXANDER MAZO, Ph.D., Institute of Molecular Biology, Academy of the Sciences of the USSR, 1986: Drosophila developmental genetics; regulation of homeotic genes.

JAY L. ROTHSTEIN, B.S., Ph.D., University of Chicago, 1988: Genetics and Immunology of the thyroid. Transgenic and conditional animal models of papillary thyroid carcinoma and autoimmune thyroiditis; the function of the RET/PTC oncogene in promoting cancer and autoimmune disease of the susceptible thyroid.

LINDA SIRACUSA, B.S., Ph.D., State University of New York at Buffalo/ Roswell Park Cancer Institute, 1985: Molecular genetics and biology of cancer susceptibility genes. Identification and characterization of genes influencing cancer susceptibility to intestinal, colorectal and skin tumors. Immunogenetics: Identification and characterization of genes and mutations involved in mammalian development and disease.

CHARLENE J. WILLIAMS, B.A., Ph.D., Rutgers and the University of Medicine and Dentistry of New Jersey, 1983: Genetic linkage analysis of osteo- and inflammatory arthropathies; positional cloning of disease susceptibility genes for osteo- and inflammatory arthropathies; isolation and characterization of genes in normal and diseased cartilage; molecular ecology.

EDWARD P. WINTER, B.A., Ph.D., State University of New York at Stonybrook, 1984: Meiotic development; chromosome structure and function; MAP kinase signaling pathways in yeast.

ALBERT J. WONG, B.A., M.D., Johns Hopkins University, 1983: Genetic alterations in human tumors with emphasis on signal transduction pathways.

Assistant Professors

MARTYN K. DARBY, B.Sc., Ph.D., University Birmingham, United Kingdom, 1981: In vitro evolution, design and structure of novel proteins with unique RNA binding activities. Regulation of RNA polymerase II directed transcription.

STEVEN A. FARBER, B.S.E., S.M., Ph.D., Massachusetts Institute of Technology, 1993: Visualization of lipid-mediated signaling and lipid metabolism in vivo using optical biosensors; genetic screens for modifiers of lipid processing in the zebrafish.

JAMES B. JAYNES, B.S., Ph.D., University of Washington (Seattle), 1987: Developmental biology and genetics; transcription factor interactions during development of Drosophila; genetic control of pattern formation.

Course Descriptions

GE 511, 521, 531* Experimental Methods I, II, III (Buchberg)

Credits 3
Each semester/session

Supervised rotations in faculty research laboratories. This course provides formal training in laboratory methods and experimental design obtained by rotations through the laboratories of different preceptors working on diverse problems in genetics. Emphasis is placed on the principles of scientific methodology and experimental design, recording and interpretation of data, and technical reporting of data.

GE 610 Transcriptional Regulation (Darby)

Credits 2
Spring II

An advanced seminar course which focuses on current topics of interest in the regulation of eukaryotic gene expression. Regulatory mechanisms of eukaryotic gene expression during development will be covered. Emphasis will be placed on the types of experimental methods used to study gene expression in eukaryotes.

GE 611* Introduction to Molecular Genetics, Part I (Jaynes)

Credits 3

This course is a comprehensive overview of the fundamental genetic principles and mechanisms of prokaryotes and eukaryotes, from bacteria to Drosophila. Section I (9 classroom hours) covers fundamental genetic principles and molecular mechanisms, including genetic mapping, an overview of the structure of genes and chromosomes, replication and transcription, as well as plasmids, recombination and DNA repair. Section II (11 classroom hours) covers basic yeast genetics and molecular biology, from concepts of mutant classification and suppression, yeast plasmids, mating, knockout technology, sporulation, tetrad analysis and recombination mechanisms, to yeast genomics. Section III (15 classroom hours) covers developmental principles in relation to genetic analysis, including gradients, signals, and transcription factors in development, classifications of mutants and phenotypes, polytene chromosomes, transposable elements, genetic screens both classical and current, mosaic analysis, conserved pathways including homeotic gene complexes, their regulation and function, and the regulation of gene expression by chromatin structure.

GE 612* Introduction to Molecular Genetics, Part II (Siracusa)

Credits 3

This course explores the molecular genetics and functional genomics of the mouse as a model mammalian system. Section I focuses on a brief review of the principles of Mendelian genetics, including equal segregation and independent assortment. Principles governing non-Mendelian inheritance patterns are investigated. Mapping strategies for single gene and polygenic traits in the mouse are also covered. Section II focuses on the development and applications of transgenic and gene targeting technologies to manipulate the mouse genome. This section also focuses on mutagenesis strategies, genomic imprinting and X-inactivation. Section III focuses on selected topics in mouse genetics. The course concludes with summations of different mouse models of a variety of human diseases.

GE 636* Cell Cycle, Growth Factors and Oncogenes (Calabretta)

Credits 3
Fall

Factors controlling cell growth and mechanisms initiating cell proliferation will be discussed. Foremost will be a consideration of proto-oncogenes and their role in the regulation of cell cycle traverse. Mechanisms of proto-oncogene activation to oncogenes and the role of oncogenes and suppressor genes in uncontrolled cell proliferation and cell transformation will be discussed via a consideration of original papers and student presentations. Assigned reading.

GE 637* Advanced Human Genetics (Huebner)

Credits 3
Spring I

Molecular principles of human diseases with special emphasis on the diseases that are currently under active investigation with the technologies of molecular biology. General review of the principles of human diseases and how the major

problems posed by these diseases can be examined experimentally. Among the diseases to be covered will be mutations in hemoglobin genes that produce heritable anemias; mutations in the phenylalanine hydroxylase gene that produce phenylketonuria; mutations in the LDL receptor that produce familial hypercholesteremia; mutations that produce deficiencies of lysosomal enzymes in syndromes such as Krabbe disease; mutations that produce muscular dystrophy; and mutations that produce cystic fibrosis. In addition, there will be an in-depth discussion of totally mapping the human genome and the potentials for gene therapy. Topics will be covered primarily in a seminar format in which students first review with the faculty original articles from the literature and then have a chance to discuss the articles with a visiting scientist who authored one or more of them. Assigned reading.

GE 651 Pathobiology of Cancer (Mercer)

Credits 3

The course covers the classification of human cancers, characteristics of neoplastic cells, epidemiology of cancers, causes of cancer, experimental carcinogenesis and the immune response against neoplastic cells. Lectures and discussions are held on these individual topics. Assigned readings.

GE 652* Molecular Basis of Cancer (Donovan)

Credits 2
Spring II

This advanced seminar course emphasizes the molecular and genetic basis of neoplasia, including oncogene activation, tumor suppressor genes, chromosomal translocation and deletions. Models of multistep tumorigenesis in transgenic mice.

GE 710, 720, 730* Seminars in Genetics I, II, III (Forbes, Lock)

Credits 1 or 2
Fall, Spring I, Spring II

Students and faculty report on recent developments in areas of research interest on departmental research projects. Visiting scientists are also invited to present seminars. Required for all graduate students in Genetics.

GE 910, 920, 930* Research (Buchberg)

Credits variable
Fall, Spring, Summer

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525 Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: Bl 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

BI 535* Biochemistry and Molecular Biology III - Metabolism (Allen)

Credits 3
Prerequisite: Organic Chemistry
Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

GC 640* Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 660 Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

PA 510* Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

PR 670 Biotechnology (Benovic)

Credits 3

The chemistry and applications of solid phase peptide synthesis, oligonucleotide synthesis, and the sequencing of proteins and DNA will be covered. Heavy emphasis will be placed on instrumental approaches to problems in modern molecular genetics and cellular biology. Among topics to be included in this section are the uses of computers as research tools (molecular modeling/molecular dynamics; X-ray crystallography and NMR analysis; use and availability of database; use and availability of data analysis packages). Other instrumental topics will include LASER-assisted cell sorting, image analysis, quantitative and qualitative spectroscopy (CD, ORD, IR, UV and fluorescence). The last section of this course will cover recent developments and methodologies in immunology (hybridoma techniques, Western blot, ELISA etc.).

*Required core courses.

Ph.D. Program in Immunology

The graduate program in Immunology, one component of the Joint Ph.D. Programs (refer to that section in this Catalog), allows students to concentrate within this field under the structure of the Department of Microbiology and Immunology and the Kimmel Cancer Center.

Application can be made either to the Joint Ph.D. Programs or directly to the Immunology Ph.D. Program. Students entering with a baccalaureate degree will take core curriculum courses in biochemistry, molecular biology, and immunology, as well as other elective introductory courses offered by the College of Graduate Studies. Advanced courses in immunology can be taken in both the first and second years of study. Laboratory rotations will allow students to experience different areas of immunology research before choosing a preceptor and direction for thesis work by the end of the first year. Concentrated thesis research continues from then on as the predominant activity for the remainder of the student's graduate experience. Guidance for the student in his research is provided by the research advisor and a thesis faculty committee. Students are given the opportunity to continue to develop their scientific base in immunology through weekly journal clubs and research seminars.

Typical areas of research include: antigen presentation, autoimmunity, B-cell development, cancer immunology, cell growth regulation and differentiation, cellular immunology, cell activation and signal transduction cytokines, developmental immunology, immunochemistry, immunogenetics, immunoparasitology, immunoregulation, molecular immunology, neuroimmunology, reproductive immunology, transplantation immunology, and viral immunology.

Program Requirements

Required Courses

		Credits
IM 505	Fundamentals of Immunology	4
IM 610,620,630	Research Rotation in Immunology I, II, III	3 each
IM 712,722,732	Current Literature in Immunology I, II, III	1 each
IM 910,920,930	Research	variable
BI 515,525	Biochemistry and Molecular Biology I, II	3 each
GC 640	Research Ethics: The Responsible Conduct of Research	1
PA 510	Concepts in Cell Biology	3
GE 612	Molecular Genetics, Part II	3

Required Advanced Elective Courses

(Offered in even years:)		
IM 626	Contemporary Topics in Immunology	3
IM 631	Advanced Cellular Immunology	3
IM 632	Molecular Immunology and Immunogenetics	3
(Offered in odd years:)		
IM 530	Infection and Immunity	3
IM 622	Tumor Immunology	3
IM 623	Immunopathology	3

Recommended Introductory Elective Courses

		Credits
GC 660	Statistical Methods for Data Analysis	2
MI 600	Microbiology	3

Optional Advanced Elective Courses In Other Areas

BI 535	Biochemistry and Molecular Biology III - Metabolism	3
DB 615	Developmental Biology & Teratology I - Embryology	3
GE 637	Advanced Human Genetics	3
GE 652*	Molecular Basis of Cancer	2
PA 530	Basic Mechanisms of Disease	3
PR 670	Biotechnology	3
PR 680	Molecular Pharmacology	3

* Required if on Training Grant

Graduate Faculty

Professors

DAVID ABRAHAM, B.S., M.S., Ph.D., University of Pennsylvania, 1983:, Parasite immunology. Role of eosinophils in innate and adaptive immunity to nematode parasite infections, vaccine development against *Onchocerca volvulus,* mechanism of immune control of infections and disease caused by *Strongyloides stercoralis;* chemotherapy of leishmaniasis.

DAVID BERD, B.S., M.D., Jefferson Medical College, 1968: Cancer immunology and immunotherapy, specifically immune response to human malignant melanoma and novel immunotherapies: tumors and blood lymphocytes prior to and following immunization with hapten-modified autologous tumor; T cells from tumors that are regressing in response to immunotherapy.

BRUNO CALABRETTA, B.S., M.D., Ph.D., University of Modena, 1977; Ph.D., University of Rome, 1987: Molecular biology of normal and leukemic hematopoiesis. Cancer immunology; hematopoiesis and the molecular basis of growth regulation of lymphocytes and leukemic cells; role of the nuclear proto-oncogene c-myb in T-lymphocyte proliferation.

CATHERINE E. CALKINS, B.A., Ph.D., Purdue University, 1972: Cellular immunology; immunoregulation of antiself reactivity; autoimmune disease; antiviral immunity; Hepatitis B virus.

CARLO M. CROCE, M.D., University of Rome, Italy, 1969: Chairman of the Department of Microbiology and Immunology, Director of the Kimmel Cancer Center: Cancer immunology; molecular basis of B- and T-cell neoplasms; role of chromosomal translocations in hematopoietic malignancies; mechanism of gene rearrangement in B and T cells.

NEAL FLOMENBERG, B.S., M.D., Thomas Jefferson University, 1976: Marrow transplantation and graft-host interaction, characterization and manipulation of the immune response to malignant tissues in an allogeneic setting (such as graft versus leukemia responses), approaches for gene therapy of congenital disorders such as sickle cell anemia.

ROBERT KORNGOLD, B.A., M.S., Ph.D., University of Pennsylvania, 1979: Director of Graduate Program in Immunology: Transplantation, autoimmunity, and T-cell immunobiology; problems related to bone marrow transplantation, including graft-versus-host disease (GVHD), graft failure, and graft-versus-leukemia responses; the T-cell response to minor histocompatibility antigens; development, mechanism, and therapeutic inhibitory effects of structure-base designed peptides.

TIMOTHY MANSER, B.A., Ph.D., University of Utah, 1982: The molecular and cellular basis for the generation of immune memory in the B-cell compartment; mechanism of a V-gene somatic hypermutation; mechanisms of positive and negative selection in the germinal center and other microenvironments; control of B-cell autoreactivity.

GEORGE F. MURPHY, B.S., M.D., University of Vermont, 1976: Pathobiology of cutaneous inflammation; molecular mechanisms of leukocyte-endothelial adhesion, cellular apoptosis, and neural regulation of leukocyte trafficking and immunity.

BICE PERUSSIA, M.D., University of Milano, Italy, 1974: Cellular immunology, with focus on innate immunity; natural killer cells, their biology, interaction with other hematopoietic cells, and differentiation; function and structure of relevant receptors; molecular mechanisms of lymphocyte activation and signal transduction; cytokines and their role in regulating immune responses.

J. BRUCE SMITH, B.S., M.D., Bowman Gray School of Medicine, 1965: Role of T cells in the development or perpetuation of osteoarthritis; immunohistochemical studies on synovial tissue from patients with OA.

PHILIP N. TSICHLIS, M.D., University of Athens Medical School, 1968: Genetics of retrovirus-induced rodent lymphomas; signal transduction in normal and neoplastic cells; apoptosis and the regulation of the cell cycle.

Associate Professors

ARTHUR M. BUCHBERG, B.S., Ph.D., State University of New York at Buffalo, 1983: Director of Graduate Program in Genetics; (1.) Molecular biology and genetics of myeloid leukemogenesis, identification of genetic modifiers involved in cancer. (2.) Immunogenetics: steps involved in murine myeloid and B-cell leukemogenesis, with emphasis on the identification and characterization of novel proto-oncogenes; creation of a molecular genetic map of the mouse in order to identify candidate genes for classical mouse mutations, regions of homology between the mouse and human genomes, and mouse models of human disease. (3.) Mouse genetics and virology; identifying the steps involved in MuLV-induced myeloid and B cell leukemia; examining the components of MuLV involved in tissue tropism and disease.

PETER J. DONOVAN, B.S., Ph.D., University College London, 1981: Molecular genetics of development; role of growth factors and receptors; cell-cycle regulation in development and gametogenesis; pluripotent stem cells.

LAURENCE C. EISENLOHR, B.A., V.M.D., Ph.D., University of Pennsylvania, 1988: Director of Program in Microbiology and Molecular Virology; Antigen processing and presentation; elucidating the subcellular events that contribute to the generation of peptides for presentation to cytotoxic and helper T-lymphocytes; determining how modulation of antigen impacts primary and memory T-cell responses; implications for vaccine design, autoimmunity, and anti-tumor immunity.

ULRICH RODECK, M.D., Germany, 1981: Mechanisms of immune escape by solid tumor cells with special reference to immunosuppressive cytokines and death receptors; coordinate regulation of cell cycle progression and survival by cytokine- and adhesion-dependent signal transduction.

JAY L. ROTHSTEIN, B.S., Ph.D., University of Chicago, 1988: Genetics and Immunology of the thyroid. Transgenic and conditional animal models of papillary thyroid carcinoma and autoimmune thyroiditis; the function of the RET/PTC oncogene in promoting cancer and autoimmune disease of the susceptible thyroid.

LINDA SIRACUSA, B.S., Ph.D., State University of New York at Buffalo/ Roswell Park Cancer Institute, 1985: Molecular genetics and biology of cancer susceptibility genes. Identification and characterization of genes influencing cancer susceptibility to intestinal, colorectal and skin tumors. Immunogenetics: Identification and characterization of genes and mutations involved in mammalian development and disease.

Assistant Professors

D. CRAIG HOOPER, B.S., Ph.D., McGill University, 1983: Immunology and neuroimmunology; T cell-dependent inflammatory mechanisms; the role of free radicals and their products in immunity; mechanisms of immune cell invasion into CNS and peripheral tissues; central nervous system (CNS) autoimmunity and immunopathogenesis; immune clearance of CNS viral infection; priming of CD4 T cells to CNS antigens; the effect of the peroxynitrite inhibitor uric acid on immunity.

YURI K. SYKULEV, M.D., Ph.D., Pyrogov Moscow State Medical Institute, 1982: Mechanisms of lymphocyte activation; factors limiting responses of T cells that recognize viral infected and cancer cells; implication for vaccine development; regulation of T and NK cell activities by density of class I MHC-peptide complexes on target cells.

JIANKE ZHANG, B.Sc., Ph.D., Purdue University, 1993: Immune tolerance and homeostasis, lymphocyte apoptosis, cytokine-receptor signal transduction, lymphocyte development; signal transduction mechanisms by the Fas/TNF receptor family members which mediate apoptosis and growth/proliferation; transgenic and gene targeting (knockout) analyses of protein functions in mice.

Course Descriptions

IM 505* Fundamentals of Immunology (Korngold)

Credits 4
Spring I

A comprehensive course encompassing the major areas of Immunology: 1) the cells and organs of the immune system; 2) nature of antigens, antibodies, and receptors; 3) lymphocyte activation, proliferation, and differentiation; 4) the major histocompatibility complex; 5) regulation of the immune response; 6) effector mechanisms of immunity; and 7) immunologic mechanisms in disease. The format will involve both lecture and discussion of specific topics, and students will be encouraged to acquire an understanding of classical and modern immunological concepts through analysis of their experimental bases. Discussion of critical techniques in Immunology will be incorporated throughout the course. Assigned reading.

IM 523 Parasite Immunology (Abraham)

Credits 3

Discussions will be focused on the immune response to parasites. Emphasis will be given to how parasites of man are eliminated from immune hosts and to the mechanisms parasites employ to evade the immune response.

IM 530* Infection and Immunity (Abraham/Eisenlohr)

Credits 2
Prerequisite: IM 505 or equivalent
Offered Spring II in odd years only

This course provides students with an introduction to the field of microbial immunology. Lectures will focus on particular infectious agents and will discuss how the immune response reacts to the organisms and what the organisms do to evade immune-mediated elimination. Organisms ranging from viruses through bacteria to protozoa, helminths, and arthropods will be studied.

IM 610, 620, 630* Research Rotation in Immunology I, II, III (Korngold)

Credits 3
Each semester/session

Students spend time in laboratories of program faculty, discussing the ongoing research projects and conducting experiments. Students are encouraged to read the background literature for the research area and to begin to develop approaches to the problem. These rotations are a prelude to selection of a research advisor.

IM 622* Tumor Immunology (Rothstein)

Credits 2
Offered Spring II in odd years only

This course is intended to give the student an in-depth analysis of how tumors develop and interact with the immune system. Oncogenes and leukemogenesis will be discussed along with our current understanding of tumor antigens. The cellular and humoral basis for generating immune responses to tumor challenge will be studied along with the theoretical background and experimental findings to support modern approaches of immunotherapy. Topics will be studied by lecture and discussion of reading assignments.

IM 623* Immunopathology (Korngold)

Credits 2
Offered Spring II in odd years only

In-depth analysis of current research in transplantation immunology, neuro-immunology, and reproductive immunology. Student presentation and discussion of literature.

IM 631* Advanced Cellular Immunology (Calkins/Perussia)

Credits 3
Offered Spring II in even years only

Current concepts and controversies in ontogeny, molecular and cellular interactions, activation and regulation of normal and defective immune responses. Primarily discussion of current literature.

IM 632* Molecular Immunology and Immunogenetics (Manser)

Credits 3
Offered Spring II in even years only

This course concentrates on the molecular and genetic basis for lymphocyte receptor signal transduction, activation, and maturation. Emphasis will also be placed on the role of cytokines and interaction molecules for antigen recognition and cytotoxic mechanisms. The immunogenetics of MHC and non-MHC molecules and their impact upon immune responses will also be discussed. Through assigned reading and discussion of notable scientific literature in these areas, students will gain a basic understanding of the current concepts.

IM 712, 722, 732* Current Literature in Immunology I, II, III (Sykulev)

Credits 1 each
Fall, Spring I, Spring II

A weekly presentation and discussion of recent literature in Immunology for students and faculty. Students will present on a rotating basis and are encouraged to participate in the general discussion.

IM 910, 920, 930* Research (Korngold)

Credits variable
Fall, Spring, Summer

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525* Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: BI 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

BI 535 Biochemistry and Molecular Biology III - Metabolism (Allen)

Credits 3
Prerequisite: Organic Chemistry
Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

DB 615 Developmental Biology and Teratology I: Embryology (McHugh)

Credits 3
Fall

Embryogenesis encompasses development of an organism from fertilization to birth. DB 615 will describe the fundamental and historical concepts of morphogenesis and cell differentiation as they pertain to the early embryo, body axis formation, and development and maturation of the major organ systems, including the placenta. Emphasis will be placed on comprehensive descriptions of developmental systems.

GC 640* Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 660 Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

GE 611 Introduction to Molecular Genetics, Part I (Jaynes)

Credits 3

This course is a comprehensive overview of the fundamental genetic principles and mechanisms of prokaryotes and eukaryotes, from bacteria to Drosophila. Section I (9 classroom hours) covers fundamental genetic principles and molecular mechanisms, including genetic mapping, an overview of the structure of genes and chromosomes, replication and transcription, as well as plasmids, recombination and DNA repair. Section II (11 classroom hours) covers basic yeast genetics and molecular biology, from concepts of mutant classification and suppression, yeast plasmids, mating, knockout technology, sporulation, tetrad analysis and recombination mechanisms, to yeast genomics. Section III (15 classroom hours) covers developmental principles in relation to genetic analysis, including gradients, signals, and transcription factors in development, classifications of mutants and phenotypes, polytene chromosomes, transposable elements, genetic screens both classical and current, mosaic analysis, conserved pathways including homeotic gene complexes, their regulation and function, and the regulation of gene expression by chromatin structure.

GE 612* Introduction to Molecular Genetics, Part II (Siracusa)

Credits 3

This course explores the molecular genetics and functional genomics of the mouse as a model mammalian system. Section I focuses on a brief review of the principles of Mendelian genetics, including equal segregation and independent assortment. Principles governing non-Mendelian inheritance patterns are investigated. Mapping strategies for single gene and polygenic traits in the mouse are also covered. Section II focuses on the development and applications of transgenic and gene targeting technologies to manipulate the mouse genome. This section also focuses on mutagenesis strategies, genomic imprinting and X-inactivation. Section III focuses on selected topics in mouse genetics. The course concludes with summations of different mouse models of a variety of human diseases.

GE 651 Pathobiology of Cancer (Mercer)

Credits 3

The course covers the classification of human cancers, characteristics of neoplastic cells, epidemiology of cancers, causes of cancer, experimental carcinogenesis and the immune response against neoplastic cells. Lectures and discussions are held on these individual topics. Assigned readings.

GE 652* Molecular Basis of Cancer (Donovan)

Credits 2
Spring II

This advanced seminar course emphasizes the molecular and genetic basis of neoplasia, including oncogene activation, tumor suppressor genes, chromosomal translocation and deletions. Models of multistep tumorigenesis in transgenic mice.

MI 600 Microbiology (Eisenlohr)

Credits 3
Spring I

This course provides students with an introduction to the field of microbiology. Lectures will focus on particular infectious agents and will discuss the pathogenesis, immunology, physiology, cell biology, pharmacology, and molecular biology of these organisms.

PA 510* Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

PR 680 Molecular Pharmacology (Benovic)

Credits 3
Prerequisite: PA 510 or BI 550
Spring II

This course focuses on regulation of cell function through an understanding of hormone, neurotransmitter and drug action at the molecular level. Specific emphasis will be placed on the mechanisms by which cell surface receptors, GTP binding proteins, effector enzymes and ion channels mediate signal transduction in the cell.

*Required core courses.

The Joint Ph.D. Programs

The Ph.D. Programs in Genetics, Immunology, Microbiology and Molecular Virology, and Molecular Pharmacology and Structural Biology share many common features and operate as the *"Joint Ph.D. Programs."* Thus, recruitment and review of applications are carried out by a combined Admissions Committee. Upon admission, a temporary Advisory Committee is appointed for the matriculating student. In the first year, students enroll in a common core course curriculum consisting of biochemistry, molecular and cell biology, as well as other courses appropriate to their specific interests. As part of their formal course work, students also perform three rotations in the research laboratories of faculty members of the Joint Ph.D. Programs; advanced laboratory techniques and the principles of sound experimental design and interpretation are learned during these courses. At the end of the first year, students choose an academic advisor and elect a specific degree Program. The requirements and goals of the chosen Ph.D. Program guide the student's subsequent course selection. Students with advanced standing and specific interests can be readily accommodated. Application should be made to the "Joint Ph.D. Programs."

Program Requirements

[Please refer to specific programs for course descriptions.]

Required Courses

		Credits
BI 515,525	Biochemistry and Molecular Biology I, II	3 each
GC 640	Research Ethics: The Responsible Conduct of Research	1
PA 510	Concepts in Cell Biology	3
Two of the four "Fundamentals" courses:		
IM 505	Fundamentals of Immunology	4
GE 611	Introduction to Molecular Genetics, Part I	3
PR 680	Molecular Pharmacology	3
MI 600	Microbiology	3

A seminar course Fall Semester and each of the two Spring Sessions; three research rotations in laboratories of any faculty member of the Joint Ph.D. Programs; and research credits in any of the Joint Ph.D. Program areas (i.e., GE 910,920,930).

Recommended Elective Courses

BI 535	Biochemistry and Molecular Biology III	3
GC 660	Statistical Methods for Data Analysis	2

Ph.D. Program in Microbiology and Molecular Virology

The Graduate Program in Microbiology and Molecular Virology provides doctoral students with a broad background in all aspects of microbiology, with an emphasis on virology and parasitology, while providing an environment to pursue research in areas of their own specialized interests. The Microbiology and Molecular Virology Program operates in conjunction with the Ph.D. Programs in Biochemistry and Molecular Biology, Genetics, Immunology, and Molecular Pharmacology and Structural Biology as part of the Joint Ph.D. Programs. Application can be made either to the Joint Ph.D. Programs or directly to the Microbiology Ph.D. Program; for a description of the operation of the Joint Ph.D. Programs, refer to that section in this Catalog. In their first year, matriculating students enroll in a common core course curriculum consisting of biochemistry, cell and molecular biology and microbiology. During this first year, students will spend time in three different laboratories before selecting their specific areas of research. Concentrated thesis research usually begins during the first summer of study, and continues as the predominant activity throughout the student's graduate school experience. Further opportunities for broad scientific growth arise through weekly research seminars and journal clubs and through frequent informal discussions with faculty and other students. Opportunities for teaching general microbiology laboratories to medical and undergraduate students will also be available.

Typical areas of research include: chemical and antigenic structure of virus particles, viral replication, antiviral agents, regulation of viral gene expression, viral oncogenes, virus-cell interactions, latent virus infections, neurovirology, microbial immunology, microbial pathogenesis, anti-parasite vaccine development, cell biology of malaria, immune control of nematode infections and disease.

For information on the Master of Science Program in Microbiology, see that section later in this Catalog.

Program Requirements

Required Courses		Credits
MI 600	Microbiology	3
MI 640,650,660	Research Rotation	3 each
MI 711,721,731	Current Literature of Microbiology I, II, III	1 each
MI 910,920,930	Research	variable
BI 515,525	Biochemistry and Molecular Biology I, II	3 each
GE 611	Introduction to Molecular Genetics - Part I	3
GC 640	Research Ethics: The Responsible Conduct of Research	1
IM 505	Fundamentals of Immunology	4
IM 530	Infection and Immunity	3

Specialty Elective Courses — Credits

Virology		
MI 531	Medical Virology	2
MI 590 A, B	Introduction to Clinical Virology APB	1 each
MI 611	Molecular Virology	2
MI 670	Viral Morphogenesis	2
MI 675	Vaccinology	2
MI 685	Neurovirology	3
MI 689	Emerging Infectious Diseases	2
Bacteriology		
MI 530	Pathogenesis of Disease	2
MI 624	Microbial Physiology	3
MI 633	Mycoplasmas and Bacterial L-Forms	2
MI 675	Vaccinology	2
MI 689	Emerging Infectious Diseases	2
Parasitology		
IM 523	Parasite Immunology	3
MI 514	Medical Parasitology	2
MI 675	Vaccinology	2
MI 689	Emerging Infectious Diseases	2
Mycology		
MI 532	Medical Mycology	2
MI 675	Vaccinology	2
MI 689	Emerging Infectious Diseases	2

Recommended Elective Courses from Other Programs

BI 535	Biochemistry and Molecular Biology III - Metabolism	3
DB 615	Developmental Biology & Teratology I - Embryology	3
GE 637	Advanced Human Genetics	3
GE 652	Molecular Basis of Cancer	2
GC 660	Statistical Methods for Data Analysis	2
IM 622	Tumor Immunology	3
IM 623	Immunopathology	3
IM 631	Advanced Cellular Immunology	3
IM 632	Molecular Immunology and Immunogenetics	3
PA 510	Concepts in Cell Biology	3
PA 570	Pathologic Aspects of Disease	3
PR 670	Biotechnology	3

Graduate Faculty

Professors

DAVID ABRAHAM, B.S., M.S., Ph.D., University of Pennsylvania, 1983: Parasite immunology. Role of eosinophils in innate and adaptive immunity to nematode parasite infections, vaccine development against *Onchocerca volvulus,* mechanism of immune control of infections and disease caused by *Strongyloides stercoralis;* chemotherapy of leishmaniasis.

TIMOTHY M. BLOCK, B.A., Ph.D., State University New York at Buffalo, 1979: Director for the Jefferson Center for Biomedical Research at Delaware Valley College. Herpes virus latency, molecular mechanisms of herpes virus pathogenesis, and hepatitis B & C virus morphogenesis; analysis and pursuit of antiviral agents, glycovirology; proteomics as a diagnostic tool.

CARLO M. CROCE, M.D., University of Rome, Italy, 1969: Chairman of the Department of Microbiology and Immunology, Director of the Kimmel Cancer Center: Cancer immunology; molecular basis of B- and T-cell neoplasms; role of chromosomal translocations in hematopoietic malignancies; mechanism of gene rearrangement in B and T cells.

BERNHARD DIETZSCHOLD, B.S., D.V.M., University of Giessen, Germany, 1967: Delineation of molecular mechanisms involved in the development of virus-induced neurological dysfunctions; characterization of anti-viral immune effectors in the CNS; development of new treatment modalities for virus-induced encephalopathies.

MARK A. FEITELSON, Ph.D., University of California at Los Angeles, 1979: Cellular and molecular mechanisms responsible for the pathogenesis of chronic hepatitis B and C virus infections, especially in the development of hepatocellular carcinoma; animal models of chronic hepatitis B and C virus infection; structure and function of the hepatitis B X gene product; contribution of alcohol and underlying viral infection to alcoholic liver diseases.

W. EDWARD MERCER, B.S., Ph.D., Pennsylvania State University, 1980: Molecular biology of normal and mutated human tumor suppressor genes and their role in the regulation of cell proliferation; alterations in normal tumor suppressor proteins by DNA tumor virus oncoproteins.

ROGER J. POMERANTZ, B.A., M.D., Johns Hopkins, 1982: HIV latency and molecular pathogenesis; molecular mechanisms of HIV-1 and retroviral transmission; neuropathogenesis of retroviral diseases; transcriptional control of HIV-1 and other retroviruses; intracellular immunization and gene therapeutic techniques to combat HIV-1 infection and novel HIV-1 vaccine approaches.

ALAGARSAMY SRINIVASAN, M.S., M.Ph., Ph.D., Jawaharlal Nehru University, 1977: Retroviruses: structure, replication, and virion morphogenesis; HIV volecular biology; role of HIV genes in AIDS pathogenesis; enetic heterogeneity of HIV.

THEODORE F. TARASCHI, B.A., Ph.D., Rutgers University, 1980: Current research interests focus on the characterization of 1) macromolecular transport- 2) protein trafficking- and 3) DNA repair-pathways in erythrocytes infected with the malaria parasite, *Plasmodium falciparum.* We are combining recent advances in parasite molecular biology and genomics with molecular cell biology and biochemistry to provide important, new information about these essential biochemical processes in *P. falciparum.*

ROCKY S. TUAN, B.A., M.A., Ph.D., Rockefeller University, 1977: Cell and molecular biology of skeletal development, growth, and disease; bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; confocal laser imaging of cells and extracellular matrix; animal models of skeletal diseases; molecular, gene-based infection diagnostics. Cellular molecular mechanisms regulating calcium metabolism and calcium-mediated functions during embryonic development, placental calcium transport, gene expression of embryo-specific calcium-binding proteins, limb chondrogenesis and embryonic skeletogenesis.

Associate Professors

ARTHUR M. BUCHBERG, B.S., Ph.D., State University of New York at Buffalo, 1983: Director of Graduate Program in Genetics; (1.) Molecular biology and genetics of myeloid leukemogenesis, identification of genetic modifiers involved in cancer. (2.) Immunogenetics: steps involved in murine myeloid and B-cell leukemogenesis, with emphasis on the identification and characterization of novel proto-oncogenes; creation of a molecular genetic map of the mouse in order to identify candidate genes for classical mouse mutations, regions of homology between the mouse and human genomes, and mouse models of human disease. (3.) Mouse genetics and virology; identifying the steps involved in MuLV-induced myeloid and B cell leukemia; examining the components of MuLV involved in tissue tropism and disease.

RALPH C. DORNBURG, Ph.D., Max-Planck Institute for Biochemistry, 1986: Gene therapy; development of retroviral vectors for cell-type-specific gene delivery, retroviral vector stability, and recombination; mouse model systems for gene therapy applications; gene therapy of HIV-1 infection.

GARRET C. DUBOIS, B.A.; Ph.D., Pennsylvania State University, 1973: Structural and functional characterization of cellular and viral proteins controlling regulation and replication of the Human Immunodeficiency Virus (HIV); structural and functional analysis of proteins instrumental in human acute and chronic leukemias.

LAURENCE C. EISENLOHR, B.A., V.M.D., Ph.D., University of Pennsylvania, 1988: Director of Program in Microbiology and Molecular Virology; Antigen processing and presentation; elucidating the subcellular events that contribute to the generation of peptides for presentation to cytotoxic and helper T-lymphocytes; determining how modulation of antigen impacts primary and memory T-cell responses; implications for vaccine design, autoimmunity, and anti-tumor immunity.

Assistant Professors

PHYLLIS R. FLOMENBERG, B.A., M.D., Albert Einstein College of Medicine, 1980: Adenoviruses; mechanisms of viral pathogenesis, viral immunology, and the development of adenovirus gene therapy applications.

D. CRAIG HOOPER, B.S., Ph.D., McGill University, 1983: Immunology and neuroimmunology; T cell-dependent inflammatory mechanisms; the role of free radicals and their products in immunity; mechanisms of immune cell invasion into CNS and peripheral tissues; central nervous system (CNS) autoimmunity and immunopathogenesis; immune clearance of CNS viral infection; priming of CD4 T cells to CNS antigens; the effect of the peroxynitrite inhibitor uric acid on immunity.

MATTHIAS J. SCHNELL, B.S., M.S., Ph.D., Federal Research Centre for Virus Diseases of Animals; Tubingen, Germany, 1994: Defective and nondefective Rhabdovirus-based vectors as vaccines (e.g., HIV-1); construction of new Rhabdoviruses to target and kill specific cells (e.g., cancer cells).

YURI K. SYKULEV, M.D., Ph.D., Pyrogov Moscow State Medical Institute, 1982: Mechanisms of lymphocyte activation; factors limiting responses of T cells that recognize viral infected and cancer cells; implication for vaccine development; regulation of T and NK cell activities by density of class I MHC-peptide complexes on target cells.

Instructor

SUSAN E. BEAR, B.A., Ph.D., Tufts University Medical School, 1980: Isolation and characterization of genes involved in the induction and progression of lymphomas.

Course Descriptions

MI 500 Medical Microbiology-Immunology (Abraham)

Credits 10
Fall

The first part of the course is basic immunology taught by an interdepartmental teaching committee. The introduction to the basic principles of immune responses is followed by a consideration of the structure, function, and genetics of bacteria, viruses, fungi and animal parasites. Medically important microorganisms are studied in detail including their effects on the host, the diseases they cause, as well as therapy and control of the organism. Host-parasite interactions are emphasized throughout. The laboratory provides practical experience in the culture, isolation and identification of disease-causing organisms.

MI 514 Medical Parasitology (Abraham)

Credits 2

Through a series of lectures and laboratory sessions, students will become familiar with the medically important parasites, their life cycles, geographic distribution, methods of transmission, pathogenicity, selection of appropriate diagnostic laboratory specimens, and the technical procedures used for identification of parasites.

MI 530 Pathogenesis (Buescher, Pellini)

Credits 2
Fall

Provides students with a framework of understanding of the complex set of interactions between bacteria and the hosts they colonize and infect. After completing this course, the students should be familiar with the myriad of mechanisms, physical and biochemical, that bacteria employ and the effects of these factors on their human hosts. This course should serve as the foundation for understanding the process of infectious diseases.

MI 531 Medical Virology (Hooper)

Credits 2
Prerequisites: MI 500 and BI 515, BI 525, or equivalent
Offered Fall alternate years

Fundamental concepts, emphasizing mechanisms and regulation of viral gene expression. Primarily discussion of literature. Students also attend JMC Microbiology lectures/Virology section.

MI 532 Medical Mycology (Buescher, Gorman)

Credits 2
Spring II

In depth discussions and laboratory study of the medically significant systemic, subcutaneous, cutaneous, superficial, and opportunistic mycoses. Emphasis will be given to a greater understanding of the morphological, physiological, and pathogenic characteristics of fungi.

MI 590A Introduction to Clinical Virology(A) (J. Buescher)

Credits 2
Spring I

Basic virology including structure of viruses and treatment and prevention of viral disease. MI 590A is the virology portion of MI 500.

MI 590B Introduction to Clinical Virology(B) (Jungkind)

Credits 1
Spring II

Techniques used in clinical laboratories to isolate and identify viruses. Lecture and laboratory.

MI 600* Microbiology (Eisenlohr)

Credits 3
Spring I

This course provides students with an introduction to the field of microbiology. Lectures will focus on particular infectious agents and will discuss the pathogenesis, immunology, physiology, cell biology, pharmacology, and molecular biology of these organisms.

MI 610 Microbiology Teaching Experience (G. Buescher)

Credits 2
Fall

Supervised practice in teaching laboratory skills and data interpretation in a microbiology teaching laboratory. During the fall semester, students will spend four hours per week engaged in the laboratory classroom instruction of students enrolled in MI 500 and may be required to prepare and present a didactic lecture at a prelaboratory conference. Students will be assessed on their ability to present information in the laboratory setting, knowledge of the subject, critique of student assignments, bench-level teaching skills, use of audiovisual and other teaching materials, and didactic presentation.

MI 611 Molecular Virology (Block)

Credits 2
Prerequisites: MI 500 and MI 531
Offered Spring I alternate years

Current understanding of viral replication with emphasis on recent advances in biochemical technology leading to this understanding. Discussion of recent literature.

MI 613 Retroviruses: Structure, Replication and Pathogenesis (Srinivasan)

Credits 2
Fall

This course provides information about retroviruses at the biological and molecular level. Retroviruses have been extensively used as model system to understand the processes involved in the development of leukemia/lymphoma. The discovery of retroviruses associated with human diseases and the possibility of using retroviruses as gene therapy vectors further stimulated research on retroviruses in the last 15 years. A major thrust of this course is to stimulate thinking about retroviruses from an experimental, therapeutic, and diagnostic point of view.

MI 614 The Biology and Pathogenesis of AIDS (Srinivasan)

Credits 2
Prerequisite: MI 613 or permission of instructor
Spring II

HIV-1 is the most studied retrovirus in human history. This course will survey the molecular and cellular biology of HIV-1, the epidemiology and disease processes associated with infection, and the pathogenic mechanisms believed to mediate the various diseases associated with AIDS. The course will also consider current animal models as well as current and potential therapies such as antisense oligonucleotides and gene therapy.

MI 615, 625 Contemporary Topics in Microbiology I, II (Block)

Credits variable, 1-3
Fall

These courses deal in depth with a specific area of microbiology. Classes are chiefly student presentations and discussions under the guidance of the instructor. The courses may be repeated with a change of content.

MI 640, 650, 660* Research Rotation (Eisenlohr)

Credits 3
Each semester/session

Supervised research in faculty laboratories. This course provides formal training in experimental design and laboratory methods by performing research rotations in the laboratories of different preceptors working on diverse problems in microbiology and molecular virology, and is a prelude to selection of a research advisor. Emphasis is placed on development and appreciation of experimental approaches to problems in the field, recording and interpretation of data and logical and lucid reporting of experimental results.

MI 670 Viral Morphogenesis (Srinivasan)

Credits 2

This course provides students with the opportunity to compare the different kinds of mechanisms involved in virus morphogenesis and to understand better the challenge that the structures of those mechanisms present to the development of effective treatment strategies.

MI 675 Vaccinology (Hooper)

Credits 2
Offered Spring II alternate years

This course provides a comprehensive survey of the various applied and developmental approaches towards vaccination against infectious organisms. Beginning with a detailed description of current vaccination strategies, the course extends into the rapidly moving field of vaccine development with discussion of novel technologies being studied for parenteral and oral vaccination including DNA-vaccines, bacterial and viral expression systems, delivery vehicles, and immunomodulation. The course provides an understanding of the nature of protective pre-exposure immunity as well as insight into approaches being used in an attempt to develop new strategies for immune intervention both prior to and following exposure to infectious agents.

MI 685 Neurovirology (Dietzschold)

Credits 3
Offered Spring II alternate years

This course addresses the basic scientific aspects of neurovirology and virus-induced neurologic disorders by providing the student with a thorough introduction to the molecular biology, pathogenesis, and sequilea of viruses that have an impact upon the nervous system. The introductory lecture focuses on the importance of neurotropic virus infections for public health. The objective of subsequent lectures is to familiarize the student with the mechanisms involved in the transmission, neuropathology, and immunopathology of virus-induced encephalopathies, as well as with the traits of specific acute and chronic viral infections of the central nervous system (CNS). Strong emphasis is placed on current developments in the field of neurovirology. In addition, students learn state-of-the-art methods used in the diagnosis of neurotropic virus infections, and become familiarized with the immunoprophylactic procedures currently used in the control of such diseases.

MI 689 Emerging Infectious Diseases (Block)

Credits 2
Offered Spring II alternate years

Topics for discussion are presented from the perspective of emerging disease as examples of species jumping, mutation, global transport, reemergence, etc. Each session is divided into a 1-hour presentation (initially led by the instructor) and a second hour of discussion. The discussion focuses upon an assigned reading topic from the text of an original journal article and may take a "round robin" format, with different students commenting upon different aspects of the assigned reading. The final set of presentations and discussions are entirely student-led.

MI 711, 721, 731* Current Literature of Microbiology I, II, III (Abraham, Schnell)

Credits 1
Fall, Spring I, Spring II

A weekly journal club in which students and faculty critically discuss papers in the current literature. Required for first and second year graduate students.

MI 910, 920, 930* Research (Eisenlohr)

Credits variable
Fall, Spring, Summer

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525 Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: BI 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

BI 535* Biochemistry and Molecular Biology III - Metabolism (Allen)

Credits 3
Prerequisite: Organic Chemistry
Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GE 611* Introduction to Molecular Genetics, Part I (Jaynes)

Credits 3

This course is a comprehensive overview of the fundamental genetic principles and mechanisms of prokaryotes and eukaryotes, from bacteria to Drosophila. Section I (9 classroom hours) covers fundamental genetic principles and molecular mechanisms, including genetic mapping, an overview of the structure of genes and chromosomes, replication and transcription, as well as plasmids, recombination and DNA repair. Section II (11 classroom hours) covers basic yeast genetics and molecular biology, from concepts of mutant classification and suppression, yeast plasmids, mating, knockout technology, sporulation, tetrad analysis and recombination mechanisms, to yeast genomics. Section III (15 classroom hours) covers developmental principles in relation to genetic analysis, including gradients, signals, and transcription factors in development, classifications of mutants and phenotypes, polytene chromosomes, transposable elements, genetic screens both classical and current, mosaic analysis, conserved pathways including homeotic gene complexes, their regulation and function, and the regulation of gene expression by chromatin structure.

GE 612* Introduction to Molecular Genetics, Part II (Siracusa)

Credits 3

This course explores the molecular genetics and functional genomics of the mouse as a model mammalian system. Section I focuses on a brief review of the principles of Mendelian genetics, including equal segregation and independent assortment. Principles governing non-Mendelian inheritance patterns are investigated. Mapping strategies for single gene and polygenic traits in the mouse are also covered. Section II focuses on the development and applications of transgenic and gene targeting technologies to manipulate the mouse genome. This section also focuses on mutagenesis strategies, genomic imprinting and X-inactivation. Section III focuses on selected topics in mouse genetics. The course concludes with summations of different mouse models of a variety of human diseases.

IM 505* Fundamentals of Immunology (Korngold)

Credits 4
Spring I

A comprehensive course encompassing the major areas of Immunology: 1) the cells and organs of the immune system; 2) nature of antigens, antibodies, and receptors; 3) lymphocyte activation, proliferation, and differentiation; 4) the major histocompatibility complex; 5) regulation of the immune response; 6) effector mechanisms of immunity; and 7) immunologic mechanisms in disease. The format will involve both lecture and discussion of specific topics, and students will be encouraged to acquire an understanding of classical and modern immunological concepts through analysis of their experimental bases. Discussion of critical techniques in Immunology will be incorporated throughout the course. Assigned reading.

IM 523 Parasite Immunology (Abraham)

Credits 3

Discussions will be focused on the immune response to parasites. Emphasis will be given to how parasites of man are eliminated from immune hosts and to the mechanisms parasites employ to evade the immune response.

IM 530* Infection and Immunity (Abraham, Eisenlohr)

Credits 2
Prerequisite: IM 505 or equivalent
Offered Spring II in odd years only

This course provides students with an introduction to the field of microbial immunology. Lectures will focus on particular infectious agents and will discuss how the immune response reacts to the organisms and what the organisms do to evade immune-mediated elimination. Organisms ranging from viruses through bacteria to protozoa, helminths, and arthropods will be studied.

IM 622* Tumor Immunology (Rothstein)

Credits 2
Offered Spring II in odd years only

This course is intended to give the student an in-depth analysis of how tumors develop and interact with the immune system. Oncogenes and leukemogenesis will be discussed along with our current understanding of tumor antigens. The cellular and humoral basis for generating immune responses to tumor challenge will be studied along with the theoretical background and experimental findings to support modern approaches of immunotherapy. Topics will be studied by lecture and discussion of reading assignments.

IM 623* Immunopathology (Korngold)

Credits 2
Offered Spring II in odd years only

In-depth analysis of current research in transplantation immunology, neuroimmunology, and reproductive immunology. Student presentation and discussion of literature.

IM 631* Advanced Cellular Immunology (Calkins, Perussia)

Credits 3
Offered Spring II in even years only

Current concepts and controversies in ontogeny, molecular and cellular interactions, activation and regulation of normal and defective immune responses. Primarily discussion of current literature.

IM 632* Molecular Immunology and Immunogenetics (Manser)

Credits 3
Offered Spring II in even years only

This course concentrates on the molecular and genetic basis for lymphocyte receptor signal transduction, activation, and maturation. Emphasis will also be placed on the role of cytokines and interaction molecules for antigen recognition and cytotoxic mechanisms. The immunogenetics of MHC and non-MHC molecules and their impact upon immune responses will also be discussed. Through assigned reading and discussion of notable scientific literature in these areas, students will gain a basic understanding of the current concepts.

PA 510 Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

PA 570 Pathologic Aspects of Disease (Fenderson)

Credits 3
Summer

The course will cover topics in general and systemic pathology, providing an overview of major aspects of human pathology and the pathophysiology of major diseases. Lectures supplemented with computer module containing case studies, clinical correlations and self-assessment components.

PA 610 Pathology (Rubin, et al.)

Credits 9

Material is presented by organ systems, and emphasis is on pathogenesis, pathologic physiology, and clinicopathologic correlations of human diseases. Instruction consists of formal lectures (7-8 hours per week), laboratory sessions, small group conferences, demonstration of gross specimens, visits to the morgue. The course also includes reviews of histology and gross pathology with the aid of photographic transparencies and clinicopathologic conferences in conjunction with the clinical departments.

PA 611* Advanced Topics in Cell Biology (Hoek)

Credits 4

This course offers an in-depth treatment of selected areas of cell biology, focusing on topics that are currently receiving a great deal of attention and largely based on research interests of faculty members of the Department of Pathology, Anatomy and Cell Biology. The course consists of four distinct sections of two weeks each, with different topics being covered in each of these sections.

*Required core courses

Ph.D. Program in Molecular Pharmacology and Structural Biology

The Graduate Program provides focused training and research experience in molecular pharmacology and structural biology, as well as in the study of drug interactions at the level of the cell and organ. The Program emphasizes molecular aspects of pharmacology involving receptor-ligand interactions and signal transduction systems. Another focus is in structural biology providing state-of-the-art approaches to understanding biological structure and function at the molecular level. The Program is designed to provide students with the basis for successful careers as independent scientists and scholars, either in the academic or industrial sectors. Students are trained in molecular and cellular approaches to research in pharmacology, providing a sound basis for an appreciation of drug/environmental interactions at the tissue and whole animal level. The program is flexible to accommodate students with advanced standing and/or with specific interests in the field.

The Molecular Pharmacology and Structural Biology Program is an interdepartmental effort sponsored by the Kimmel Cancer Center and the Department of Biochemistry and Molecular Pharmacology. It operates in conjunction with the Ph.D. Programs in Genetics, Immunology, and Microbiology and Molecular Virology as part of the Joint Ph.D. Programs. Application can be made either to the Joint Ph.D. Programs or directly to the Pharmacology Graduate Program; for a description of the operation of the Joint Graduate Programs, refer to that section in this Catalog. In their first year, matriculating students enroll in a common core course curriculum consisting of biochemistry, cell and molecular biology, as well as other courses appropriate to their interests such as *Molecular Pharmacology*. As part of their formal coursework, students also perform three rotations in the research laboratories of faculty members; advanced laboratory techniques and the principles of sound experimental design and interpretation are learned during these courses. At the end of the first year, students choose an academic advisor. During the second year, more specialized courses are taken which can include *Biotechnology, Special Topics in Cell Regulation, Molecular Basis of Cancer, Neuropsychopharmacology*, or *Special Topics in Structural Biology.*

Typical areas of faculty research include: biochemistry and molecular and cell biology of hormone-receptor interactions and signal transduction mechanisms within cells, mechanisms of membrane sorting and intracellular organization, neuropharmacology, molecular modeling and design of therapeutic agents, NMR and crystal structures of proteins and nucleic acids, the computational analysis of the structure and energetics of biological macromolecules, psychopharmacology, clinical pharmacology, and toxicology.

Program Requirements

Required Courses

		Credits
PR 522	General Pharmacology	3
PR 640,650,660	Research Rotation	3 each
PR 680	Molecular Pharmacology	3

PR 710,720,730	Seminar	1 each
PR 910,920,930	Research	variable
BI 515,525,535	Biochemistry and Molecular Biology I,II,III	3 each
GC 640	Research Ethics: The Responsible Conduct of Research	1
PA 510	Concepts in Cell Biology	3

Recommended Elective Courses

PR 612	Special Topics in Pharmacology	2
PR 613	Protein Structure and Function - Structural Biology I	2
PR 615	Special Topics in Cell Regulation	2
PR 618	Special Topics in Structural Biology	2
PR 760	Clinical Pharmacology Seminar	2
BI 614	Protein Structure and Function - Structural Biology II	2
GE 611	Introduction to Molecular Genetics, Part I	3
GE 652	Molecular Basis of Cancer	2
GC 660	Statistical Methods for Data Analysis	2
IM 505	Fundamentals of Immunology	4

Graduate Faculty

Professors

EMAD S. ALNERMI, B.S., M.S., Ph.D., Temple University, 1991: Molecular mechanisms of programmed cell death (apoptosis); signal transduction by death receptors in apoptosis and cancer; intracellular apoptosis regulating complexes.

JEFFREY L. BENOVIC, B.S., Ph.D., Duke University, 1986; Director of Graduate Program in Molecular Pharmacology and Structural Biology; Molecular and regulatory properties of G. protein-coupled receptors; elucidation of the role of G protein-coupled receptor kinases and arrestins in receptor regulation.

GEORGE C. BRAINARD, B.A., M.A., Ph.D., University of Texas, San Antonio, 1982: Photobiology and neuroendocrine regulation; control of melatonin in humans and animals; effects of light on behavior and mood.

JOHN L. FARBER, B.A., M.D., University of California, San Francisco, 1966: Biochemical mechanisms of cell injury in ischemia; biochemical toxicology of liver cell necrosis; biochemical toxicology of activated oxygen; chemical carcinogenesis.

RICHARD A. FISHEL, B.S., Ph.D., University of California, Irvine, 1980: The mechanisms and regulation of DNA repair and recombination in human cells; the role of DNA repair in tumorigenesis with emphasis on human mutator genes.

BARRY J. GOLDSTEIN, B.S., M.D., Ph.D., University of Rochester School of Medicine, 1982; Insulin receptor signal transduction; role of protein-tyrosine phosphatases in the regulation of insulin action and insulin-resistant disease states.

JAN B. HOEK, Ph.D., University of Amsterdam, 1972: Director of Graduate Program in Pathology and Cell Biology; Cellular aspects of hormonal regulation and its disturbance in response to acute and chronic alcohol treatment; the regulation of cellular calcium homeostasis; the role of calcium in intracellular transduction of hormonal signals; the regulation of phosphoinositide-linked signal transduction system; mitochondrial function and control of cellular energy conservation.

JAMES H. KEEN, A.B., Ph.D., Cornell University, 1976: Molecular mechanisms coupling signal transduction with receptor-mediated endocytosis and exocytosis; membrane transport studied by biochemical, molecular biological, and morphological approaches.

GERALD LITWACK, B.A., M.S., Ph.D., University of Wisconsin, 1953: Chairman of the Department of Biochemistry and Molecular Pharmacology; Vice Dean for Research, JMC; Biochemistry and molecular biology of glucocorticoid and mineralocorticoid receptors and associated immunophilins; mode of action and structure of modulator and glucocorticoid-induced programmed cell death.

JOSE MARTINEZ, B.S., M.D., Universidad Central, Madrid, 1957: Role of fibrin in the differentiation of endothelial cells toward the formation of capillary tubes.

SUSAN E. RITTENHOUSE, A.B., Ph.D., Harvard, 1972: Cellular signaling events involving phosphatidylinositide species; the regulation of the enzymes that metabolize these entities.

PHILIP N. TSICHLIS, M.D., University of Athens Medical School, 1968: Genetics of retrovirus-induced rodent lymphomas; signal transduction in normal and neoplastic cells; apoptosis and the regulation of the cell cycle.

SCOTT A. WALDMAN, B.S., Ph.D., M.D., Stanford University, 1987: Molecular mechanisms of signal transduction, with special emphasis on the coupling of peptide ligand-receptor interactions to activation of effector mechanisms.

ERIC WICKSTROM, B.S., Ph.D., University of California, Berkeley, 1972: Antisense oligonucleotides for cancer therapy; antigenomic oligonucleotides for viral therapy; gene insertion at defined sequences for congenital diseases.

Associate Professors

CHARLES BRENNER, B.A., Ph.D., Stanford University, 1993: Functions of the histidine triad proteins using X-ray crystallography, enzymology, and yeast genetics.

PETER J. DONOVAN, B.S., Ph.D., University College London, 1981: Molecular genetics of development; role of growth factors and receptors; cell-cycle regulation in development and gametogenesis; pluripotent stem cells.

GARRET C. DUBOIS, B.A., Ph.D., Pennsylvania State University, 1973: Director of Protein Chemistry Laboratory: Structural and functional characterization of cellular and viral proteins controlling regulation and replication of the Human Immunodeficiency Virus (HIV); structural and functional analysis of proteins instrumental in human acute and chronic leukemias.

MARKUS W. GERMANN, B.S., Ph.D., University of Calgary, Alberta, Canada, 1989: Structural investigation of nucleic acids and proteins by nuclear magnetic resonance.

YA-MING HOU, B.S., M.A., Ph.D., University of California, Berkeley, 1986: Structural and functional analysis of tRNA mutants; molecular biology of protein-RNA interaction; genetic screening and in vitro mutagenesis, design and creation of novel RNA molecules that function in vivo and in vitro.

EDWARD P. WINTER, B.A., Ph.D., State University of New York at Stonybrook, 1984: Meiotic development; chromosome structure and function; MAP kinase signaling pathways in yeast.

ALBERT J. WONG, B.A., M.D., Johns Hopkins University, 1983: Genetic alterations in human tumors with emphasis on signal transduction pathways.

Assistant Professor

PHILIP B. WEDEGAERTNER, B.S., Ph.D., University of California, San Diego, 1991: G protein signal transduction; molecular mechanisms and functions of covalent modifications and regulated subcellular localization.

Course Descriptions

PR 500 Pharmacology (Beck)

Credits 10

The course consists of lectures, correlations and discussions as well as laboratory exercises. The general fields of pharmacology and toxicology are covered, including the origins, chemical nature, mechanisms of action and interactions, of pharmacological agents, major effects, absorption and fate of drugs and poisons. Emphasis is given to the study of those drugs which are used in present day medicine and to the study of toxic agents most commonly affecting man. In the laboratory, the student gains an understanding of some of the mechanisms by which drugs may produce their effects, and becomes familiar with a variety of methods and procedures commonly employed in experimental pharmacology.

PR 522* General Pharmacology (Waldman)

Credits 3
Fall

Introduction to the basic principles of drug action, including molecular mechanisms, time and dose dependency of drug actions, pharmacokinetics, toxicity, resistance and tolerance, pharmacogenetics, mutagenesis, carcinogenesis, and drug development and evaluation.

PR 525 Principles of Clinical Pharmacology (Waldman)

Credits 3
Spring I

The objectives of this course are to present the principles of clinical pharmacology and practical therapeutics, including understanding and application of basic pharmacokinetic principles, basic pharmacodynamic principles, drug regimen design, therapeutic drug monitoring, adverse drug reactions, drug discovery and drug developments, principles of clinical study designs, biostatistics and pharmacology analysis.

PR 530 Fundamentals of Biosafety (Grunwald, Souder)

Credits 2
Spring I

The purpose of this course is to provide students with a basic knowledge of biosafety as related to good laboratory practice. The course will begin with an introduction to Federal biosafety regulations, guidelines and standards, the role of the Biological Safety Officer in the institution and the epidemiology of laboratory-associated infections. Students will become familiar with: concepts in biotechnology and cell biology; means of exposure to biohazardous agents; hazard assessment in the laboratory; laboratory design criteria when using biohazardous agents; good laboratory practice, (GLP); decontamination, sterilization, disinfection and proper disposal of infectious waste; packaging and shipping of biohazardous material; biosafety training design and implementation; and special considerations related to gene therapy.

PR 540 Introduction to Structural Biology and Bioinformatics (Brenner)

Credits 2
Spring II

The objective of this course is to lay the foundations of Bioinformatics and Structural Biology. Fundamental features of the structure of proteins and nucleic acids, and the relationship between structure, sequence and function will be explored with a combination of lecture and hands on computer experiments. The goal is to use the structural information and databases to design and analyze experiments to understand the biological function.

PR 610 Colloquium of Cell Calcium (Benovic)

Credits 3

Calcium is one of the primary cell signals for integrating cell function in various physiological states. The course deals with the basic role of calcium in regulating cell membrane structure and function. The various calcium activated proteins, troponin, calmodulin, protein kinase C, parvalbumins, and calsequestion and other calcium binding proteins are considered in the context of cell regulation. The course consists of several lectures combined with student presentations of original papers selected. Each student is expected to participate in the colloquium on cell calcium. Students are graded on the basis of their participation. Two open-book quizzes are given and a final term paper is required in lieu of a final exam.

PR 612 Special Topics in Pharmacology (Benovic)

Credits 2

Each year this course integrates knowledge derived from the various basic medical sciences, pertaining to a selected organ or system, for example, the heart, brain, kidney, liver, etc. The student may thus take the course in several successive years without repeating the subject matter. Classes are chiefly student presentations and discussions under the guidance of the instructor. Instruction is given in writing abstracts and papers for publication and in presenting papers at seminars and scientific meetings.

PR 613 Protein Structure and Function - Structural Biology I (Wickstrom)

Credits 2
Prerequisites: BI 515, BI 525 or permission of instructor
Spring I

This course is designed to train the graduate student in current methods used in the field of protein structure determination. Experimental techniques to be covered include X-ray crystallography and diffraction techniques, magnetic resonance spectroscopy (NMR and EPR), optical spectroscopy (UV/VIS, circular dichroism), and fluorescence spectroscopy. The use of computers and computer modeling in data analysis will also be emphasized. Various proteins, protein systems, and enzymes will be examined.

PR 615 Special Topics in Cell Regulation (Benovic)

Credits 2

This course focuses on a critical analysis of current concepts of cell regulation mediated by hormones and second messenger signal transduction systems.

PR 618 Special Topics in Structural Biology (Benovic)

Credits 2

This course offers an analysis of current approaches for relating physical structure to biological function in specific systems, such as the interaction of hormone or drug molecules with protein or nucleic acid receptors.

PR 621 Colloquium on Eicosanoids (Benovic)

Credits 2

This course reviews current knowledge of the physiological and pharmacological aspects of the prostaglandins from macromolecular to organismic levels. The formation, metabolism, and biological effects of the prostaglandins, thromboxanes, prostacyclins, leukotrienes and their associated products will be discussed.

PR 625 Animal Pharmacology (Barone, Landi)

Credits 3
Fall

This course provides basic training for M.S. and Ph.D. students in animal pharmacology. The specific goals of the course are: 1) to provide basic principles of *in vivo* drug experimentation conducted on anesthetized and conscious animals. Principles of animal anesthesia, surgical procedures, pre- and post-operative care will be studied along with regulatory and ethical aspects of experimentation on small and large laboratory animals; 2) to provide basic knowledge and insights on animal models of human disease and the scientific and technical issues associated with the use of laboratory animals in drug development.

Principles of pharmacodynamics and pharmacokinetics will be introduced, along with major organ and systemic pharmacology of the heart, kidney, brain, blood vessels, and the pulmonary system; 3) to provide an opportunity to acquaint students with modern pharmacology research in an industrial set-up and the fundamentals of the processes of drug discovery.

PR 630 General Toxicology (Middleberg)

Credits 3
Summer

This course will introduce students to the principles and practices of Toxicology. Emphasis will be given to the comprehensiveness of toxicology as opposed to individual academic interests. While introductory courses in biochemistry, physiology, anatomy, and pharmacology would be helpful, they are not necessary since each topic will be covered as an introduction to the subject matter.

PR 631 Neuropsychopharmacology (Benovic)

Credits 2

The course begins with a review of basic neurochemistry, neuroanatomy, and neurophysiology as it relates to nerve conduction and neurotransmission. This is followed by a discussion of the various theories of the biochemical basis of anxiety, depression, aggression, schizophrenia and movement disorders and of drugs used in the treatment of these disorders including site and mode of action. In each case, animal models of a particular disorder are described.

PR 632 Metabolism of Foreign Compounds (Benovic)

Credits 3

A general consideration of the biotransformation of drugs, the influence of genetic factors and enzyme induction on such transformations, and the importance of these factors in therapeutics.

PR 635 Clinical Pharmacotoxicology (Kocsis)

Credits 3
Spring I

This course gives the student an understanding of the concepts, knowledge, and skills which provide the basis for applications such as effectively providing consultative and laboratory testing services. Students will also become familiar with other aspects of pharmacotoxicology, such as research and development, quality assurance/quality control, education, and training relating to prevention, diagnosis, and treatment; forensic and regulatory aspects of harmful/toxic effects of exogenous chemicals.

PR 640, 650, 660* Research Rotation in Molecular Pharmacology and Structural Biology (Benovic)

Credits 3
Each semester/session

Supervised research in faculty laboratories. This course provides formal training in experimental design and laboratory methods by performing research rotations in the laboratories of different preceptors who are working on diverse problems in molecular pharmacology and structural biology. The course is a prelude to selection of a research advisor. Emphasis is placed on development and appreciation of experimental approaches to problems in the field, recording and interpretation of data, and logical and lucid reporting of experimental results.

PR 670 Biotechnology (Benovic)

Credits 3

The chemistry and applications of solid phase peptide synthesis, oligonucleotide synthesis, and the sequencing of proteins and DNA will be covered. Heavy emphasis will be placed on instrumental approaches to problems in modern molecular genetics and cellular biology. Among topics to be included in this section are the uses of computers as research tools (molecular modeling/molecular dynamics; X-ray crystallography and NMR analysis; use and availability of database; use and availability of data analysis packages). Other instrumental topics will include LASER-assisted cell sorting, image analysis, quantitative and qualitative spectroscopy (CD, ORD, IR, UV and fluorescence). The last section of this course will cover recent developments and methodologies in immunology (hybridoma techniques, Western blot, ELISA etc.).

PR 680* Molecular Pharmacology (Benovic)

Credits 3
Prerequisite: PA 510 or BI 550
Spring II

This course focuses on regulation of cell function through an understanding of hormone, neurotransmitter and drug action at the molecular level. Specific emphasis will be placed on the mechanisms by which cell surface receptors, GTP binding proteins, effector enzymes and ion channels mediate signal transduction in the cell.

PR 690 Pharmacology of the Central Nervous System (Benovic)

Credits 2

The overall objective of this course is to provide graduate students with an understanding of how therapeutic and non-therapeutic drugs affect brain function. The series begins with several lectures devoted to fundamental neurobiology including introductions to neuroanatomy and neurophysiology. These are followed by presentations on specific topics of neurochemistry and neuropharmacology as they relate to the biochemical basis of specific diseases and disorders of the brain. The series is complemented by sessions focusing upon animal models, research directions, and clinical applications.

PR 710, 720, 730* Seminar (Wickstrom)

Credits 1
Fall, Spring I, Spring II

Presentation of research reports and review of special topics by faculty, graduate students, and speakers invited from other institutions.

PR 760 Clinical Pharmacology Seminar (Waldman)

Credits 2
Spring II

This course examines the application of Clinical Pharmacology fundamentals employing a practical, case-oriented approach. Employing real-life cases, the problem solving will be more realistic, and the learning better reinforced. This "case approach" has been used in leading medical and business schools for many years. The fundamental topics of clinical pharmacology that were initially presented in Pharmacology 525 or 401 will be applied here in clinical scenarios to reinforce the educational process. These include pharmacokinetics, pharmacodynamics, therapeutic drug monitoring, drug interactions, drug metabolism, adverse drug reactions, pharmacogenetics, elements of biostatistics and clinical trials, and dosage regimen design.

PR 910, 920, 930* Research (Benovic)

Credits variable
Fall, Spring, Summer

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525 Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: BI 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

BI 535* Biochemistry and Molecular Biology III - Metabolism (Allen)

Credits 3
Prerequisite: Organic Chemistry
Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

BI 614 Protein Structure and Function (Zeiger)

Credits 3
Prerequisite: BI 515 or BI 550
Spring II

The course is intended to introduce students to the high-tech resources and techniques available at Thomas Jefferson University that are useful in studying protein structure and folding. These will include brief presentations of biological data bases and molecular sequence analysis, X-ray crystallography, mass spectrometry, circular dichroism, nuclear magnetic resonance, electron spin resonance, plasmon resonance and molecular modeling. There will be a discussion of some proteins; for example, DNA-binding proteins and membrane-bound proteins that are particularly amenable to study by these techniques.

GE 652* Molecular Basis of Cancer (Donovan)

Credits 2
Spring II

This advanced seminar course emphasizes the molecular and genetic basis of neoplasia, including oncogene activation, tumor suppressor genes, chromosomal translocation and deletions. Models of multistep tumorigenesis in transgenic mice.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

GC 680 Laboratory Techniques in Molecular Biology (Buescher, Kuo)

Credits 2
Maximum number of students 16
Fall, Spring II

The purpose of the course is to introduce the students to basic techniques in molecular biology, including genetic engineering. Beginning with an introduction to the biological significance of DNA and the fundamentals of good laboratory practices, students will become familiar with: purification and characterization of nucleic acids; cloning vectors, enzymes used in DNA cloning, and *E. coli* host strains; principles of restriction mapping, recombinant library construction, and the polymerase chain reaction; production and use of nucleic acid probes in hybridization to filter-immobilized DNA. Students will be instructed in the biochemical and biological concepts involved in the selected molecular biology techniques so that, at the completion of the course, students will have the ability to work through technical problems in this “kit-oriented” era, and to assimilate new techniques as they arise.

PA 510* Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

*Required core courses.

Ph.D. Program in Pathology and Cell Biology

The graduate program in pathology and cell biology is oriented toward studies of cellular and molecular mechanisms underlying disease processes. The student who enters with a baccalaureate degree spends the first year in course work, including general biochemistry, selected topics and techniques in cell biology, and an introductory course to pathology. Laboratory rotations will familiarize the student with the major areas of research in the Department. In the second year, additional options are selected from the course offerings in the College of Graduate Studies. Throughout the program, the student is expected to attend the departmental grand rounds, the seminar series of the Alcohol Research Center, participate in the departmental Journal Club, and various research discussion groups depending upon the research project in which he or she is involved. Annually, students present a seminar on their research progress. Recruitment and admissions for the program in Pathology and Cell Biology and the Developmental Biology and Teratology program are administered by the Department of Pathology, Anatomy, and Cell Biology.

Typical areas of research include: liver diseases; cellular and molecular aspects of alcoholism; structure-function relationships in biological membranes; biochemistry of cell injury and apoptosis; cellular signaling; calcium metabolism; protein kinase C; Structure and function of K+ channels; mitochondrial function; cell biology and immunology of malaria; molecular biology of extracellular matrix genes; transfection and functional characterization of proteoglycan genes; developmental aspects of oncology, chemical carcinogenesis; basement membranes in disease stares; renal pathology; radiation pathology; regulation of cellular growth; and use of enzymes to control tumor growth.

Program Requirements

Required Courses		Credits
PA 510	Concepts in Cell Biology	3
PA 570	Pathologic Aspects of Disease	3
PA 611	Advanced Topics in Cell Biology	4
PA 710,720	Seminar/Journal Club (bi-weekly; 2-3 annual presentations per student)	1,2
PA 910,920,930	Research	variable
BI 515,525,535	Biochemistry and Molecular Biology I, II, III	3 each
GE 651	Pathobiology of Cancer	3
GC 640	Research Ethics: The Responsible Conduct of Research	1

Journal Club (biweekly)
Grand Rounds (weekly)
Alcohol Research Center seminars
Weekly research discussions in area of student's specialization

Recommended Elective Courses (A partial list)		Credits
BI 624	Extracellular Matrix Proteins and Complex Carbohydrates	2
DB 615	Developmental Biology and Teratology I: Embryology	
DB 625	Developmental Biology and Teratology II: Mechanisms of Development	3
DB 635	Developmental Biology and Teratology III: Mechanisms of Teratogenesis	3
GE 611	Introduction to Molecular Genetics	3
GE 636	Cell Cycle, Growth Factors & Oncogenes	3
IM 505	Fundamentals of Immunology	4
IM 622	Tumor Immunology	3
PR 522	General Pharmacology	3
PS 520	Mammalian Physiology	10

Graduate Faculty

Professors

EMANUEL RUBIN, B.S. M.D., Harvard Medical School, 1954: The Gonzalo E. Aponte Professor of Pathology, Anatomy and Cell Biology and Chairman of the Department: Clinical and experimental liver disease; cellular effects of alcohol; membrane biology.

RONALD A. COSS, B.A., Ph.D., University of Colorado, 1974: Cell biology: radiation biology; cell cycle, mitosis, and cytokinesis; nuclear matrix and cytomatrix; heat shock of cells in culture; determination of critical cellular structures whose modification by heat shock results in cell death.

LEONARD M. EISENMAN, B.A., M.A., Ph.D., Duke University, 1974: Neuroscience; anatomical, developmental, and functional studies of the organization of the cerebellum; the normal and abnormal development of this structure analyzed with the use of rodents and neurologically mutant mice; special emphasis given to the development of the topographic and synaptic organization of afferent systems to the cerebellum.

JOHN L. FARBER, B.A., M.D., University of California, San Francisco, 1966: Biochemical mechanisms of cell injury in ischemia; biochemical toxicology of liver cell necrosis; biochemical toxicology of activated oxygen; chemical carcinogenesis.

MARK A. FEITELSON, Ph.D., University of California at Los Angeles, 1979: Cellular and molecular mechanisms responsible for the pathogenesis of chronic hepatitis B and C virus infections, especially in the development of hepatocellular carcinoma; animal models of chronic hepatitis B and C virus infection; structure and function of the hepatitis B X gene product; contribution of alcohol and underlying viral infection to alcoholic liver diseases.

GERALD B. GRUNWALD, B.A., M.S., Ph.D., University of Wisconsin, 1981, Associate Dean CGS, Director of Graduate Program in Developmental Biology and Teratology; Developmental biology, neuroscience; analysis of cell-cell interactions during development of the nervous system and the eye; studies of regulation of cadherin cell adhesion molecule

expression and function in development and disease using biochemical, cell biological, immunological and molecular genetic methods.

JAN B. HOEK, Ph.D., University of Amsterdam, 1972: Director of Graduate Program in Pathology and Cell Biology; Cellular aspects of hormonal regulation and its disturbance in response to acute and chronic alcohol treatment; the regulation of cellular calcium homeostasis; the role of calcium in intracellular transduction of hormonal signals; the regulation of phosphoinositide-linked signal transduction system; mitochondrial function and control of cellular energy conservation.

RENATO V. IOZZO, M.D., University of Florence, 1975: Molecular biology of proteoglycan genes, decorin and perlecan; abnormal expression in tumor stroma; mechanisms regulating the tissue expression of decorin; biosynthesis, structure and metabolism of proteoglycans in normal and malignant cells.

YEDY J. ISRAEL, Ph.D., University of Toronto, 1965: Triple-helix antigene and gene therapy in alcoholic liver disease; generation and accumulation of ethanol-derived free radical adducts in the liver following chronic alcohol consumption.

SURESH K. JOSEPH, B.Sc., Ph.D., University of Bristol, 1978: Structure, function, and regulation of the inositol trisphosphate receptor (IP3R); biosynthesis and assembly of IP3R homo- and heterooligomers; mechanisms of proteasomal and lysosomal degradation of IP3R. Alcohol research; calcium metabolism; cell biology; membrane biology, receptors and signal transduction.

DONALD L. JUNGKIND, B.S., M.S., Ph.D., University of Texas at Galveston, 1972: Sexually transmitted diseases and automation in clinical microbiology.

THOMAS B. KNUDSEN, B.S., Ph.D., Thomas Jefferson University, 1981: Developmental biology and teratology; mitochondrial mechanisms of teratogenesis; genomic basis of differential teratogen susceptibility; programmed cell death in the early embryo.

PETER A. McCUE, B.A., M.Ms., M.D., Mount Sinai School of Medicine, City University of New York, 1977: Clinical and experimental pathobiology of neoplasia; the effects of retinoids on the differentiation of germ cells and related tumors; the role of nuclear receptors and cytosolic binding proteins for retinoic acid in differentiation-defective cell lines.

GEORGE F. MURPHY, B.S., M.D., University of Vermont, 1976: Pathobiology of cutaneous inflammation; molecular mechanisms of leukocyte-endothelial adhesion, cellular apoptosis, and neural regulation of leukocyte trafficking and immunity.

RAPHAEL RUBIN, B.A., M.D., Boston University, 1979: Tyrosine kinase signaling processes; effects of ethanol on intercellular signal transduction; liver pathology.

DAVID S. STRAYER, M.D., Ph.D., Chicago: Genetic determinants of viral virulence and virus interaction with infected cells; regulation of pulmonary surfactant secretion and of surfactant protein gene expression; role of epidermal growth factor and like cytokines in oncogenesis; control of cell division using cell-cycle control proteins.

CHRISTOPHER D. STUBBS, B.Sc., M.Sc., Ph.D., University of London, 1976: Biochemistry/biophysics; effects of drugs, anesthetics and ethanol on cell membrane structure and function;

use of fluorescence spectroscopic techniques to determine membrane lipid organization and protein-lipid interactions.

THEODORE F. TARASCHI, B.A., Ph.D., Rutgers University, 1980: Current research interests focus on the characterization of 1) macromolecular transport- 2) protein trafficking- and 3) DNA repair-pathways in erythrocytes infected with the malaria parasite, *Plasmodium falciparum.* We are combining recent advances in parasite molecular biology and genomics with molecular cell biology and biochemistry to provide important, new information about these essential biochemical processes in P. *falciparum.*

Associate Professors

WILLIAM Z. BORER, B.S., M.S., M.D., University of Wisconsin, 1979: Capillary electrophoresis as an analytical tool in the clinical laboratory and development of statistical tools for the assignment of reference ranges.

MANUEL L. COVARRUBIAS, M.Sc., M.D., Ph.D., National University of Mexico, 1977; Ph.D., National University of Mexico, 1980: Molecular mechanisms that regulate the function of cloned voltage-sensitive potassium channels; recombinant DNA techniques (e.g. in vitro mutagenesis) and electrophysiological recording (e.g. patch-clamp recording) used to study the structure-function relation; the action of protein kinases, regulation of channel gating, and the action of ethanol and general anesthetics.

JOHN S. ELLINGSON, B.S., M.S., Ph.D., University of Michigan, 1967: Structure, function and biogenesis of membranes; the adaptation of membranes to ethanol with specific emphasis on the ethanol-induced alterations of chemical and physical properties of the membrane phospholipids.

BRUCE A. FENDERSON, B.S., Ph.D., Johns Hopkins University, 1980: Mechanisms of morphogenesis and malignancy; role of cell surface carbohydrates in developmental processes and differentiation; the glycolipids of human germ cell tumors and the role of hyaluronan in regulating cell migration.

GYORGY HAJNOCZKY, M.D., Ph.D., Budapest (Hungary) 1994: Intracellular calcium signaling; inositol trisphosphate-linked hormones; organization of calcium mobilization from endoplasmic/sarcoplasmic reticulum; mithochondiral calcium signaling; calcium-dependent control over life and death of cells. Fluorometric, fluorescence microscope imaging and electrophysiological approaches.

MERY KOSTIANOVSKY, M.D., Universidad Del Litoral, 1958: The effect(s) of interferons on lymphoblastoid cells in culture, with special interest on ultrastructural induction of cyto membranous structures in aids and lupus erythematosus; the interaction of antimicrotubular substances (heavy water, vinblastine, colchicine) and interferon activity on the induction of inclusions in vitro; ultrastructural pathology.

KIRK M. MCHUGH, B.S., Ph.D., University of Cincinnati College of Medicine, 1986: Molecular biology; molecular genetics of isoactin gene expression during mammalian development; development of gastrointestinal smooth muscle, utilizing a variety of molecular and cellular techniques.

A. SUE MENKO, B.A., Ph.D., University of Pennsylvania, 1978: The role of integrins in the regulation of cell differentiation; current studies focus on integrin signaling of cell differentiation events, particularly integrin-growth factor receptor coordinated signaling.

BIDDANDA C. PONNAPPA, B.S., M.S., Ph.D., University of Mysore, India, 1976: Alcoholic pancreatitis, Kupffer cell function, oligonucleotide delivery, liposomes.

ROLAND SCHWARTING, B.S., M.S., M.D., Kiel, Germany, 1981: Cell surface markers of lymphopoietic cells; gastrointestinal immunology; flow cytometry; immunohistochemistry.

ELAINE MEI LI TAN, B.Sc., M.Sc., M.B.A., Ph.D., UCLA, 1986: The biochemistry, molecular biology and pathology of atherosclerosis, diabetes, and other vascular-related diseases; alterations in connective tissue matrix production by endothelial and smooth muscle cells in culture; cellular aging and cancer.

Clinical Associate Professor

GENE L. GULATI, B.Sc., M.S., Ph.D., St. John's University, 1973: Automation in hematology; blood cell morphology, immunophenotyping; platelet function, thrombosis, and thrombolysis.

Assistant Professors

NATHAN J. JANES, B.A., Ph.D., University of Illinois-Urbana, 1985: Molecular basis of anesthetic and alcohol action; biogenesis of adaptive response to long-term exposure to alcohol and anesthetics; pathogenesis of atherosclerosis; physical chemistry of lipids and membranes; lipid biochemistry; membrane architecture; partitioning of lipophilic agents into membranes; solid-state and solution-state nuclear magnetic resonance spectroscopy of membrane dynamics and anesthetic/membrane interactions; electron spin resonance of membrane dynamics and anesthetic partitioning.

Postdoctoral Fellows

LUIGI BAGELLA
VIJAYABHASKER BAIREDDY
MARCUS BELL
EUGENEYE BICHENKOV
FRANCISCO BRANCO
PIERRE CORDELIER
GYORGY CSORDAS
ADRIAN DAVIES
VLADIMIR ERYOMIN
TARIQ KHAN
HIROAKI KOMATSU
JULIEN LANDRE
LI LI
ZUENA LIN
JIE LUI
PING LU
JIANGYING LUO
AUSRA MARCINKEVICIUTE
NIKOLAI MARKEVITCH
MARIE-ANNE MARRIERE
HUNTER MARTIN
VALERIA MASCIULLO
HAYLEY McKEE
MAURIZIO MONGIAT
MADESH MUNISWAMY
AHMAD NAIM
CARMEN NICHOLS
RICARDO PINEDA
CHARLES REED
GIUSEPPE RUSSO
MOHAMMAD SHAHIDULLEH
HITOSHI SHIMBO
JIE TANG
MALIKA TUOAB
FREDERICK WALTERS
XIAOPING YAN
JOSE ZAPATERO
XIANCHAO ZHANG

Course Descriptions

PA 510* Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

PA 570 Pathologic Aspects of Disease (Fenderson)

Credits 3
Summer

The course will cover topics in general and systemic pathology, providing an overview of major aspects of human pathology and the pathophysiology of major diseases. Lectures supplemented with computer module containing case studies, clinical correlations and self-assessment components.

PA 611* Advanced Topics in Cell Biology (Hoek)

Credits 4

This course offers an in-depth treatment of selected areas of cell biology, focusing on topics that are currently receiving a great deal of attention and largely based on research interests of faculty members of the Department of Pathology, Anatomy and Cell Biology. The course consists of four distinct sections of two weeks each, with different topics being covered in each of these sections.

PA 710, 720* Seminar (Hoek)

Credits 1, 2
Respective semesters

Journal Club. Postdoctoral fellows and graduate students discuss recent research articles relative to their area of interest.

PA 910, 920, 930* Research (Hoek)

Credits variable

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

BI 515* Biochemistry and Molecular Biology I - The Architectural Building Blocks (Zeiger)

Credits 3
Prerequisite: Organic Chemistry
Fall

This course deals with the structure and function of the basic molecules of life, the proteins, nucleic acids, carbohydrates and lipids. How the structure of these molecules determine the nature of living organisms will be discussed along with the nature and mechanisms of enzymatic catalysis.

BI 525 Biochemistry and Molecular Biology II - Genetic Information (Hou)

Credits 3
Prerequisite: BI 515
Spring

The second part of a general course in biochemistry, which covers the basic principles of both prokaryotic and eukaryotic molecular biology. The course focuses on how genetic information is transmitted and expressed on the molecular level. The subject matter includes chromosome structure, DNA replication, repair and recombination, prokaryotic and eukaryotic transcription, RNA splicing, protein synthesis, translation apparatus and mitochondrial genomes.

BI 535* Biochemistry and Molecular Biology III - Metabolism (Allen)

Credits 3
Prerequisite: Organic Chemistry
Spring II

The topics covered include the catabolic and anabolic pathways of carbohydrate, lipid, and amino acid metabolism and their biochemical interrelationships and regulation. Also addressed will be research directed at understanding the biochemical basis of a few selected diseases, as well as current research efforts in the field of metabolic regulation. Assigned reading.

DB 615* Developmental Biology and Teratology I: Embryology (McHugh)

Credits 3
Fall

Embryogenesis encompasses development of an organism from fertilization to birth. DB 615 will describe the fundamental and historical concepts of morphogenesis and cell differentiation as they pertain to the early embryo, body axis formation, and development and maturation of the major organ systems, including the placenta. Emphasis will be placed on comprehensive descriptions of developmental systems.

DB 625 Developmental Biology and Teratology II: Mechanisms of Development (Grunwald)

Credits 3
Prerequisite: DB 615 or equivalent
Spring I

This course will examine specific developmental events in detail, emphasizing contemporary concepts in cellular regulation, growth and pattern formation, differential gene expression, and cell death. Lectures and problem-based discussion groups will explore the rationale behind experimental design as it pertains to investigating principal mechanisms directing normal embryogenesis.

DB 635* Developmental Biology and Teratology III: Mechanisms of Teratogenesis (Knudsen)

Credits 3
Prerequisites: DB 615, 625 or permission of the instructor
Spring II

Teratology is the study of birth defects and their causes and includes investigations pertaining to both structural and functional abnormalities. About 2-3% of live-born infants have detectable congenital malformations at birth; the incidence often doubles by the end of the first year of life due to the discovery of abnormalities which were indiscernible at birth. These figures still do not account for intrauterine growth retardation and prenatal deaths. Like carcinogenesis, teratogenesis involves complex interactions between the genome and environment of an individual. DB 635 will explore these interactions as they pertain to the pregnant mother and fetus, integrating information regarding causal signals of abnormal development, the transduction of these signals into a teratogenic lesion, and the genes which are likely to be determining factors in abnormal embryonic development. It will also encompass a unit on applied teratology from the perspective of pharmaceutical testing to determine how human teratogens are discovered.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

GE 651 Pathobiology of Cancer (Mercer)

Credits 3

The course covers the classification of human cancers, characteristics of neoplastic cells, epidemiology of cancers, causes of cancer, experimental carcinogenesis and the immune response against neoplastic cells. Lectures and discussions are held on these individual topics. Assigned readings.

GE 652* Molecular Basis of Cancer (Donovan)

Credits 2
Spring II

This advanced seminar course emphasizes the molecular and genetic basis of neoplasia, including oncogene activation, tumor suppressor genes, chromosomal translocation and deletions. Models of multistep tumorigenesis in transgenic mice.

*Required core courses.

Ph.D. Program in Physiology

The primary goals of this graduate program are to maintain an environment that will foster and nurture the intellectual growth of our graduate students, to achieve the highest standards of quality in scientific research and education, and to produce outstanding scientists who will maintain the highest levels of integrity in the conduct of independent biomedical research. In an effort to meet these goals, we provide students with a factual basis for understanding the function of each organ system and the interrelationship of these organ systems in maintaining whole body and cellular homeostasis. We teach the scientific method as an analytic approach to physiology research, including teaching the students how to critically evaluate data, as well as search the scientific literature. We provide the students with specialized courses and supervised experience in the art of scientific communication, both written and oral. We encourage and develop independent and creative approaches to physiologic research problems to prepare the students for the conduct of basic medical research and to assume teaching responsibilities in mammalian and cellular physiology. The program is directed toward familiarizing students with contemporary concepts and trends in physiology and related areas, both through scholarship and laboratory practice.

The first year of study is mainly devoted to course work in mammalian physiology, general biochemistry, and the neurosciences. Each first-year student rotates through several faculty laboratories during the course of the year. Through this experience, the student becomes acquainted with ongoing research in departmental laboratories and gains practical experience in solving specific research problems. This rotation also facilitates selection of a thesis advisor. The predoctoral student selects a faculty member as a research advisor at the end of the first year of study and continues to stay within that laboratory until all courses and research experiments are completed.

During the second through fourth years, the student takes advanced courses that cover several major areas of physiology in depth and enrolls in related courses given by other departments. Teaching experience is acquired by assisting in undergraduate laboratory courses. With the guidance of faculty members, the advanced student also prepares and delivers lectures and conducts conferences for undergraduate students. The teaching is closely supervised and is reviewed as an integral part of the education of the students.

Throughout each year of study, the student joins faculty members, postdoctoral fellows, and other graduate students in weekly departmental seminars to which scientists from other departments or institutions are often invited as guest speakers. This series provides a forum for the exchange of scientific ideas of current interest; through free discussion, it introduces the students to constructive scientific dialogue.

Typical areas of research include: cardiovascular physiology; pathophysiology of shock; pathophysiology of myocardial ischemia; myocardial metabolism; physiology of the endothelium; contractile processes in smooth muscle; pulmonary physiology; pathophysiology of neutrophils and other leukocytes; neutrophil-endothelium interaction; gastrointestinal physiology; neurophysiology; and cellular physiology of contractile mechanisms.

Program Requirements

Required Courses

		Credits
PS 520	Mammalian Physiology	10
GC 700	Introduction to Neuroscience	3
PS 617,627,637	Literature Review	2 each
PS 710,720	Seminar	1,2
PS 730,731,732	Current Literature of Physiology I,II,III	1 each
PS 910,920,930	Research	variable
GC 640	Research Ethics: The Responsible Conduct of Research	1

At least four advanced courses from the following list:

PS 612	Pulmonary Physiology	2
PS 613	Muscle Physiology	2
PS 621	Endocrine Physiology	2
PS 623	Renal Physiology	2
PS 624	Energy Transduction in Biological Systems	2
PS 631	Membrane and Cell Physiology	2
PS 632	Cardiovascular Physiology	2
PS 633	Pathophysiology of Circulatory Disease States	2
PS 634	Advanced Neurophysiology	2
PS 722	Art of Scientific Lecturing	3
PS 723	Art of Scientific Writing	3

Other Courses

PS 521	Issues in Physiology	3
PS 640	Special Topics in Ion Channels	2
PS 650	Special Topics in Signal Transduction	2
PS 660	Special Topics in Motility	2

Graduate Faculty

Professors

THOMAS M. BUTLER. B.A., Ph.D., University of Pennsylvania, 1974: Energetics and regulation of smooth muscle contraction.

JAIME CARO, M.D., University of Chile, 1967: Molecular biology of nitric oxide syntheses; oxygen regulated gene transcription.

JOHN T. FLYNN, B.S., Ph.D., Hahnemann University, 1974: Role of arachidonic acid system in circulatory shock and cellular injury; endothelial cell interactions with bacterial lipopolysaccharides.

RICHARD HORN, B.S., M.S., Ph.D., University of California, Los Angeles, 1977: Molecular physiology of ion channels.

SATISH C. RATTAN, M.S., D.V.M., Punjab Agricultural University, India, 1968: Regulatory mechanisms underlying gastrointestinal motility.

MARION J. SIEGMAN, B.A., Ph.D., State University of New York, Downstate Medical Center, 1966: Acting Chairman of the Department: Mechanical and ultrastructural properties of smooth muscle; chemical energetics and regulation of contraction in smooth muscle.

JAMES A. SPATH, JR., B.A., M.S., Ph.D., University of Oklahoma, 1966: Pulmonary edema development after myocardial ischemia; regulation of vascular reactivity.

Associate Professor

LEONARD M. ROSENFELD, A.B., M.A., Ph.D., Jefferson Medical College, 1964: Assistant Dean, CGS: Gastrointestinal physiology.

Assistant Professors

KURT A. ENGLEKA, B.S., Ph.D., George Washington University, 1992: Endothelial cell cycle regulatory control during angiogenic signaling; gene transfection and expression methods in normal endothelial cells.

PETER L. JEPSEN, M.S., D.V.M., Washington State University, 1968: Laboratory animal science; infectious diseases.

ROSARIO SCALIA, M.D., Ph.D., University of Catania, Catania, Italy, 1992: Microcirculation; vascular biology; vascular pathology of atherosclerosis and diabetes.

MARILYN J. WOOLKALIS, A.B., Ph.D., University of California, Davis, 1981: Protease-activated receptor regulation and signal transduction in endothelial cells; cytokine activation of signaling networks in endothelial cells; modulation of endothelial cell regulatory events by fluid shear stress.

Postdoctoral Fellows

SHINGHUA DING, B.S., M.S., Ph.D., State University of New York, 1999.

YASUHIKO IKEDA, M.D., Fujita Health University School of Medicine, Japan, 1992.

LINDON H. YOUNG, B.A., Ph.D., Philadelphia College of Pharmacy and Science, 1998.

Course Descriptions

PS 520* Mammalian Physiology (including Experimental Physiology) (Spath)

Credits 10

Lectures, conferences and laboratory required of all first year graduate students in physiology. Core information on the physiologic process in health, with special attention to functions of organs and systems and the mechanisms of their integration. The physiologic bases of dysfunctions and the various aspects of applied physiology which constitute the foundations of medicine and surgery are discussed. Correlation lectures by experts from the clinical departments of this and other institutions present current concepts and the application of basic physiology to clinical medicine.

ID 520 Issues in Physiology (Rosenfeld)

Credits 3

Discusses current issues in physiology involving the major organ systems. Explores these issues in depth at the metabolic, cellular and systemic levels. Integrates the knowledge and material at these different levels. Enables the student to better appreciate the field of physiology while preparing the individual for further study.

GC 700 Introduction to Neuroscience (Grunwald, Horn)

Credits 3
Fall

Introduction to Neuroscience is a graduate lecture/seminar survey course which is designed to introduce students to basic concepts and experimental approaches to issues in the neurosciences. The course is divided into two integrated sections focusing on: 1) Neurophysiology and Synaptic Transmission, and 2) Neuroanatomy and Systems. An interdepartmental team of faculty will lead students through these topics with a series of lectures and discussions based upon assigned text readings and current journal articles.

PS 612 Pulmonary Physiology (Spath)

Credits 2

Pathophysiology of pulmonary edema; protein permeability of the air-blood barrier, diffusive and convective flux of water and protein, perivascular and peribronchial interstitial fluid cuffing, alveolar flooding, lymphatic drainage of the lung, microvascular pressure and the vascular water fall.

PS 613 Muscle Physiology (Siegman)

Credits 2

Selected topics on the properties of muscle and other tissues having contractile properties, including electrical and mechanical phenomena, energetics, neurotropism, modification of intrinsic regulation through evolution. Seminars and lectures requiring reading and discussion of classic and current literature.

PS 617, 627, 637* Literature Review (Woolkalis)

Credits 2
Each semester/session

A critical review of the recent literature on a topic of interest to the student (not related to thesis research) which includes a proposed problem of study and rationale for conducting the investigation.

PS 621 Endocrine Physiology (Woolkalis)

Credits 2

Physiology of endocrine glands; synthesis and elaboration of hormones, hormonal feedback systems, endocrine-nervous system interrelations, hypothalamic regulation of pituitary secretions, endocrine regulation of body function.

PS 623 Renal Physiology (Flynn)

Credits 2

Selected aspects of electrolyte transport with emphasis on models of sodium reabsorption, potassium excretion and adaptation, bicarbonate reabsorption, and acid excretion, evaluation of models for concentration and dilution, discussion of hormonal modulation of renal function including catecholamines, ADH, prostaglandins and the renin-angiotensin system.

PS 624 Energy Transduction in Biological Systems (Butler)

Credits 2

A discussion of energy transduction in biological systems. Topics include the thermodynamics of biological processes, energetics of muscle contraction, active transport mechanisms, and oxidative phosphorylation. Course includes student presentations of related subject material.

PS 631 Membrane and Cell Physiology (Engleka)

Credits 2

The course will focus on aspects of receptor-mediated signal transduction, activation of second messenger systems, and the regulation of cellular proliferation and differentiation. The course includes review of original literature and presentations by the students.

PS 632 Cardiovascular Physiology (Spath)

Credits 2

The course is designed to explore in detail factors underlying the contractile process and cardiac function, including the regulation of electrical, mechanical and metabolic processes in normal and pathological states. The course emphasis is on: l) the study of recent works which have contributed to our present understanding of these processes, and 2) consideration of factors affecting cardiac function of which our understanding is incomplete.

PS 633 Pathophysiology of Circulatory Disease States (Scalia)

Credits 2

Lectures, discussions, readings and seminars on current problems in the mechanisms of acute circulatory traumatic states such as circulatory shock (e.g., hemorrhagic, endotoxic, cardiogenic, bowel ischemia, etc.), acute myocardial ischemia, myocardial infarction including reperfusion injury. Emphasis will be placed on integration of physiologic mechanisms, particularly humoral mediators, responsible for disruption of circulatory homeostasis.

PS 634 Advanced Neurophysiology - Molecular Physiology of Ion Channels (Horn)

Credits 2

This course will examine the function and structure of ion channels found in the plasma membrane of excitable cells (nerves and muscles). Functional studies will stress patch clamp, single channel recording, and heterologous expression of cloned and mutated channel proteins. A theoretical introduction to the biophysics of ion channels will be presented, and current research papers will be presented by the students.

PS 640 Special Topics in Ion Channels (Horn)

Credits 2
Each semester/session

A seminar series to elucidate and integrate various aspects of contemporary knowledge of ion channel biophysics.

PS 650 Special Topics in Signal Transduction (Woolkalis)

Credits 2
Each semester/session

A seminar series to elucidate and integrate various aspects of contemporary knowledge of specific physiological phenomena and underlying signal transduction mechanisms.

PS 660 Special Topics in Motility (Butler)

Credits 2
Each semester/session

A seminar series to elucidate and integrate various aspects of motility including skeletal, cardiac, and smooth muscle biophysics and regulation.

PS 710, 720* Seminar (Engleka)

Credits 1, 2
Respective semesters

Required of all graduate students in Physiology. Presentations by staff and invited speakers of new developments in their research activities.

PS 722 Art of Scientific Lecturing (Horn)

Credits 3

This course is designed as a group practice in the art of lecturing. Students are taught principles of evaluation of scientific lectures which they subsequently use in preparing and delivering lectures. Aside from the first class, at which the philosophy, organizational plans, and techniques of effective lecturing are discussed, emphasis is placed on student presentations to the class. The topic of these presentations is selected by each student and therefore may be directed toward a research topic or a basic science subject of the student's choice. The lectures will be evaluated by each class member using a standardized form requiring notes on the scientific content as well as the presentation, and by the lecturer who will observe his/her lecture by video playback. Class discussions will be held after the evaluations are complete to assess the strengths and weaknesses of each lecture.

PS 723 Art of Scientific Writing (Flynn)

Credits 3

The purpose of this course is to provide guidelines for writing clear scientific papers. This goal is met by discussion of reading and homework assignments, and submission of a new, original scientific paper in an area chosen by each student. The paper should adhere to scientific journal format appropriate for the subject matter or discipline.

PS 730, 731, 732* Current Literature of Physiology I,II,III (Woolkalis)

Credits 1 each

The courses facilitate student development in the skills that enable them to read and evaluate critically current scientific literature. These courses will deal in depth with a specific topic in physiology. The class will meet biweekly in the format of a journal club. Class will consist of student presentations and discussions under the guidance of participating faculty. Students will present on a rotating basis and will be expected to lead a discussion of a current scientific paper.

PS 740 Historical Development of Physiology (Rosenfeld)

Credits 1

The course provides an introduction to the historical development of physiological concepts. A lecture-seminar format with selected readings of classical physiology literature gives the students a review of the historical development of recent physiological discoveries.

PS 910, 920, 930* Research (Woolkalis)

Credits variable

Under the supervision of a member of the graduate faculty and guidance of a thesis research committee, the student will learn research design, methodology, and experimental techniques relevant to the graduate program. Research leading to the doctoral thesis is a major requirement for the Ph.D. degree and will occupy a dominant part of the student's time and attention.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

*Required core courses.

Master of Science Programs

Master of Science Program in Biomedical Chemistry

This program prepares students for positions of leadership at various levels in the field, in research and development, biotechnology, molecular biology and in the development of new therapeutic modalities. Biochemical discoveries have had a great impact on the understanding and treatment of human disease. Graduates of the program may be employed as research scientists in pharmaceutical and biotechnology firms, consultants, clinical research associates, faculty in academic institutions, technical representatives for commercial companies, or laboratory managers.

The Master of Science Program in Biomedical Chemistry offers a broad-based curriculum that reflects the emergence of biotechnology and rapid technologic development in the field. The program requires a minimum of 40 semester credits, including a Master's thesis presented in a seminar-like setting of peers and faculty. Core courses include biomedical chemistry, immunology, bioanalytical techniques, statistics, and management. There are two areas of specialization within the program 1) Molecular Biology and 2) Biochemistry. Students selecting the biochemistry track will take additional courses in pathology and toxicology. The molecular biology track will include courses in laboratory techniques in molecular biology and protein structure and function. In addition students will be able to select a minimum of 8 credits of electives in areas such as pharmacoeconomics, laboratory animal science, genomics and bioinformatics, pharmacology, epidemiology, clinical trials, or presentation skills. Clerkship and research training is undertaken in areas designed to enhance students' career goals. Students may pursue advanced graduate or professional degree programs.

Applicants for admission to the program must possess a baccalaureate degree in chemistry, biology, or other health-related discipline with an appropriate chemistry background from an accredited institution and must meet the admissions requirements of the College of Graduate Studies.

The graduate program may be completed on a part-time basis over a two-to-four year period. Students may continue to hold a full-time position and thus be eligible for tuition reimbursement programs, which may be available at their place of employment.

Administration

Inquiries on the program should be directed to Georganne Buescher, Ed.D., Associate Dean, Georganne.Buescher@mail.tju.edu or Karen Dohm, Ph.D., Academic Coordinator Karen.Dohm@mail.tju.edu, room M-46, Jefferson Alumni Hall, (215) 503-5799.

Program Coordinator: Charlene Williams, Ph.D.

Program Requirements

Required Courses

		Credits
BI 550	Topics in Medical Biochemistry	3
BI 555	Bioanalytical Techniques	3
BI 712	Seminar	2
BI 810,820,830	Laboratory Clerkships	3 total
BI 870,880,890	Master's Thesis Research	6 total
GC 660	Statistical Methods for Data Analysis	2
MI 521	Introduction to Immunology	2
	or	
IM 505	Fundamentals of Immunology	4

Select from courses in Management: **6 minimum**

GC 515	Quality Measure/Outcomes Analysis In Health Care	3
GC 525	Information Systems in Organizations	3
GC 600	Management Skills	3
GC 605	Performance Improvement	3
GC 610	Strategic Management	3
GC 620	Fundamentals of Financial Management	3
GC 621	Biotechnology Venture Management	2
GC 622	Cases in Financial Management	2

Recommended Electives and Specific Track Courses (A partial list)

BI 614	Protein Structure and Function	3
GC 510	Database Design and Management	2
GC 526	Presentation Skills	2
GC 529	Laboratory Animal Sciences	2
GC 535	Introduction to Genomics and Bioinformatics	2
GC 615	Grant Management	2
GC 625	Drug Development Issues	2
GC 630	Fundamentals of Clinical Trials	3
GC 635	Fundamentals of Clinical Trial Management	2
GC 650	Pharmacoeconomics	3
GC 670	Experimental Design in Research	2
GC 680	Laboratory Techniques in Molecular Biology	2
GC 690	Regulatory Issues in Scientific Research	2
GC 720	Scientific Writing	2
MI 580	Principles of Epidemiology	2
PA 570	Pathologic Aspects of Disease	3
PR 513	Introduction to Pharmacology	3
PR 530	Fundamentals of Biosafety	2
PR 625	Animal Pharmacology	3
PR 630	General Toxicology	3

Completion and presentation of an MS Thesis are required.

Graduate Faculty

Professors

GERALD LITWACK, B.A., M.S., Ph.D., University of Wisconsin, 1953: Chairman of the Department of Biochemistry and Molecular Pharmacology; Vice Dean for Research, JMC; Biochemistry and molecular biology of glucocorticoid and mineralocorticoid receptors and associated immunophilins; mode of action and structure of modulator and glucocorticoid-induced programmed cell death.

ARTHUR ALLEN, B.A., M.A., Ph.D., Temple University, 1956: Interrelationships between carbohydrate and lipid metabolism.

JEFFREY L. BENOVIC, B.S., Ph.D., Duke University, 1986; Director of Graduate Program in Molecular Pharmacology and Structural Biology; Molecular and regulatory properties of G protein-coupled receptors; elucidation of the role of G protein-coupled receptor kinases and arrestins in receptor regulation.

TIMOTHY M. BLOCK, B.A., Ph.D., State University New York at Buffalo, 1979: Director for the Jefferson Center for Biomedical Research at Delaware Valley College. Herpes virus latency, molecular mechanisms of herpes virus pathogenesis, and hepatitis B & C virus morphogenesis; analysis and pursuit of antiviral agents, glycovirology; proteomics as a diagnostic tool.

GERALD B. GRUNWALD, B.A., M.S., Ph.D., University of Wisconsin, 1981, Associate Dean CGS, Director of Graduate Program in Developmental Biology and Teratology; Developmental biology, neuroscience; analysis of cell-cell interactions during development of the nervous system and the eye; studies of regulation of cadherin cell adhesion molecule expression and function in development and disease using biochemical, cell biological, immunological and molecular genetic methods.

ALLEN R. ZEIGER, B.A., Ph.D., Johns Hopkins University, 1967: Opioid receptors and immune function; opiate metabolism.

Research Professor

JAMES J. DIAMOND, B.S., M.S., Ph.D., Syracuse University, 1970: Statistics, research methods.

Associate Professors

BRUCE A. FENDERSON, B.S., Ph.D., Johns Hopkins University, 1980: Mechanisms of morphogenesis and malignancy; role of cell surface carbohydrates in developmental processes and differentiation; the glycolipids of human germ cell tumors and the role of hyaluronan in regulating cell migration.

CHARLENE J. WILLIAMS, B.A., Ph.D., Rutgers and the University of Medicine and Dentistry of New Jersey, 1983: Genetic linkage analysis of osteo- and inflammatory arthropathies; positional cloning of disease susceptibility genes for osteo- and inflammatory arthropathies; isolation and characterization of genes in normal and diseased cartilage; molecular ecology.

Clinical Associate Professor

DAVID NASH, M.A., M.D., M.B.A., The Wharton School, University of Pennsylvania, 1986: Health policy and clinical outcomes; pharmacoeconomics.

Adjunct Associate Professor

DENNIS M. GROSS, B.A., M.Sc., Ph.D., University of California, Los Angeles, 1974: Scientific strategist and operations expert. Drug discovery process; which elements of chemistry, biology, molecular biology, clinical research and development must be brought together in a cohesive effort in order to bring new drugs from bench to bedside.

Clinical Assistant Professor

GEORGANNE K. BUESCHER, B.S., M.S., Ed.D., Temple University, 1984: Diagnostic microbiology; rapid methods of identification, curriculum development.

Adjunct Assistant Professors

FRANK BARONE, B.A., Ph.D., Syracuse University, 1978: Discoveries in stroke and neuropharmacology.

MARGARET LANDI, B.A., M.S., V.M.D., University of Pennsylvania, 1979: Laboratory animal medicine; study of animal models of human diseases.

Adjunct Clinical Assistant Professors

JEROME G. BUESCHER, B.A., Ph.D., Thomas Jefferson University, 1981: Clinical microbiology; rapid methods, cost containment measures; quality assurance; rational test utilization.

ROBERT A. MIDDLEBERG, Ph.D., Thomas Jefferson University, 1991: Forensic toxicology; analysis of biological fluids and tissues for the presence of toxicants capable of causing death or affecting human performance; development of analytical methods for toxicants; interactions of science and the law.

Course Descriptions

BI 550* Topics in Medical Biochemistry (Allen)

Credits 3
Fall

This lecture course presents the standard topics of biochemistry and molecular biology. In addition, emphasis is placed on explaining how certain abnormal biochemical events can account for the development of certain diseases. The course also provides useful background material for some of the subsequent courses taken in the Master of Science programs in the basic sciences.

BI 555* Bioanalytical Techniques (Williams)

Credits 3
Maximum number of students 30
Spring I

Through a series of lectures and laboratory sessions students will become familiar with the scientific principles and technical performance of instruments employed in biomedical research. Various detection systems, such as fluorescence polarization, chemiluminescence and mass spectrometry will be discussed. Laboratory sessions will be conducted and will provide students with experience in immunologic assays, chromatographic and electrophoretic separation, PCR, flow cytometry, DNA techniques, and other laboratory techniques.

BI 614 Protein Structure and Function (Zeiger)

Credits 3
Prerequisite: BI 515 or BI 550
Spring II

The course is intended to introduce students to the high-tech resources and techniques available at Thomas Jefferson University that are useful in studying protein structure and folding. These will include brief presentations of biological data bases and molecular sequence analysis, X-ray crystallography, mass spectrometry, circular dichroism, nuclear magnetic resonance, electron spin resonance, plasmon resonance and molecular modeling. There will be a discussion of some proteins; for example, DNA-binding proteins and membrane-bound proteins that are particularly amenable to study by these techniques.

BI 712* Seminar (Williams)

Credits 2
Spring I

Special topics will be presented by the faculty and invited scientists. Through a study of current topics in biomedical chemistry, students will become aware of the subject coverage of various journals, the areas of research interest, and become experienced in the critical review of original research papers. Skills in communication and instruction will be developed through presentations of research and review of papers appearing in recent literature.

BI 810, 820, 830* Laboratory Clerkships (G. Buescher)

Credits 3

To gain experience and proficiency in the clinical and/or research application of biomedical chemistry, students will become familiar with state-of-the-art instrumentation and specialized research techniques in microbiology and/or molecular biology through placement in a clinical or research laboratory of the University or in an affiliate institution. The type of biomedical chemistry laboratory and duration of training for this experience will vary depending upon the student's prior experience, needs, and career goals.

BI 870, 880, 890* Master's Thesis Research (G. Buescher)

Credits 6

Laboratory investigation culminating in a written Master's research thesis. Students, working under the supervision of a research advisor, will formulate research questions, record, and analyze the research data. Presentation of completed research will be made by students prior to graduation.

GC 510 Quality Database Design and Management (Waldman, Leone)

Credits 2
Summer

This applied, "how to" course lays the groundwork for an object-oriented approach to relational database development. The approach focuses on identification, formalization, and verification of study data. Students will learn how to collect and organize information into well-developed objects and relationships. Students will have the opportunity to perform statistical analyses on several real data sets using general-purpose statistical software packages. The course will also introduce students to Epi Info®, a public domain epidemiologic database and analysis application.

GC 515 Quality Measure/Outcomes Analysis in Health Care (Nash, Goldfarb)

Credits 3
Fall

The course will cover methods for quality measurement and improvement, application of these methods in various settings and populations, and current and future directions in quality. Student will develop an understanding of issues in defining and measuring quality of care in a variety of health care settings, and learn the skills to measure quality and analyze outcomes.

GC 525 Information Management (Bross)

Credits 3
Maximum number of students 15
Fall, Spring II

This course is designed to provide a detailed understanding of information systems and their use within the modern organization. It will explore the essential components of the systems and analyze how each is developed and linked into a production system. Contemporary computing concepts will be examined and a profile of strategic information management issues will be presented. Particular emphasis will be placed on the role of technology in assisting organizations to meet their operational and strategic goals. The course incorporates Internet activities, spreadsheets, and a database management package.

GC 526 Presentation Skills (Buescher, Scott)

Credits 2
Maximum number of students 16
Spring I

This course focuses on skills needed to make successful oral presentations, and poster presentations. Although no specific prerequisite courses are required, the nature of this course demands that students be at a point in their careers where they are prepared to make both an oral and poster presentation on a topic germane to their interests.

GC 529 Laboratory Animal Sciences (Jepsen)

Credits 2
Spring II

This course will introduce students to laboratory animal science. Topics will concern regulations and their effect on the care and use of laboratory animals, the biology, husbandry, and diseases of common laboratory animal species, ethical and scientific issues, experimental surgery and animal research techniques.

GC 535 Introduction to Genomics and Bioinformatics (Williams, Pellini)

Credits 2
Spring

This course introduces the principles of medical genetics to graduate students who require a working knowledge of modern molecular genetics. The first half of the course will provide students with a background for understanding the genetics of disease. Topics to be reviewed will include: the chromosomal basis of heredity; the structure and function of genes and chromosomes; and the patterns of single and multifactorial inheritance. The second half of the course will acquaint students with the newly emerging fields of study as a result of sequencing projects (Bioinformatics, Proteomics and Pharmacogenomics) and explore the potential career opportunities in these areas. Several presentations will also be devoted to accessing DNA and protein analysis programs through the Internet, so that the student can gain hands-on experience navigating web-based information tools and extracting information from the growing number of databases available to biomedical researchers.

GC 600 Management Skills (G. Buescher, Arsenault)

Credits 3
Maximum number of students 25
Fall

This course introduces current theories and concepts of leadership and management and develops the skills necessary to successfully perform as a manager and leader. Based on input from focus groups with representatives from the pharmaceutical, biotechnology and healthcare industries, the course gives special emphasis to developing skills for collaboration, improved communication, problem solving, managing change, and reengineering.

GC 605 Performance Improvement (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Fall

This course provides an introduction to the principles and concepts of Performance Improvement, (similar to the concepts of Total Quality Management, TQM). Emphasis will be on the importance of employee involvement and critical nature of customer focus. Material will demonstrate why performance improvement is so important in any industry and how these principles and concepts can be applied. It will provide an orientation to the analytical tools used in performance improvement projects, and apply them to real work situations. Students will differentiate between the role of the project team and the role of line management. Class will discuss national quality awards and benchmarks.

GC 610 Strategic Management (Buescher, d'Arville)

Credits 3
Spring II

This course introduces the student to the Strategic Management Process as a base, to build on the basic management skills that the student has developed to date. The student will learn the nature and importance of planning; develop a "plan" for planning; relate planning to change management; and outline, investigate, and use the strategic management process. The student will learn to perform a situational audit, formulate program strategies and long and medium-range objectives, and learn the steps in strategic implementation.

GC 615 Grant Management (Grunwald)

Credits 2
Spring II

This course is designed to serve as an introductory overview of the pre- and post-application procedures that relate to the writing, submission, review, award, and management of research grants. The areas included will be covered from both the perspective of the principal investigator as well as from the administrative viewpoint.

GC 620 Fundamentals of Financial Management (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Spring I

The purpose of this course is to introduce the non-financial manager to financial systems, principles of accounting and their relationship to basic business activities. These concepts will be relevant to the research laboratory and discussion will center on basic financial statements and their analysis, financial planning, business language, and concepts, preparation and interpretation of financial statements. The use of electronic worksheets will also be incorporated in the analysis of case studies.

GC 621 Biotechnology and Venture Management (Saukkonen, Chou)

Credits 2
Summer

Students will be taught how to identify and analyze the factors that contribute to the creation of successful new business ventures. They will learn to consider the management problems associated with the founding of a new enterprise, either as a small business or as a part of an existing corporation. They will discuss the concepts, and use the methodologies for putting together a successful business plan. Emphasis in the course will be on technology-based innovation.

GC 622 Cases in Financial Management (Buescher, Chatterton)

Credits 2
Prerequisite: GC 620 or permission of instructor
Maximum number of students 8
Fall

The course is designed to provide a Case Study approach for the implementation skills learned in GC 620. Students will work as Department Managers in a health care or academic "case" organization reviewing monthly financials, recommending actions based on their review, and preparing an annual budget. Students will complete a formal budget presentation and "defense" and attend mock meetings of Department heads with the instructor acting as CEO or CFO of the organization.

GC 625 Drug Development Issues (Gross)

Credits 2
Summer

This course explores the drug development process primarily at steps post-basic research. The course will examine the domestic and international regulatory environment, current requirements, and new drivers in the development process, specifically outcomes research and pharmacoeconomics.

GC 630 Fundamentals of Clinical Trials (Hauck)

Credits 3
Minimum number of students 12
Maximum number of students 20
Fall

This course introduces students to the fundamentals of clinical trials, from choosing a question and writing a protocol, through running a trial, to analyzing and reporting results. Key topics include how to assure validity in trials, what to include in a protocol, quality assurance of ongoing trials, statistical methods for analyzing trials, and how to review critically the reports of trials.

GC 635 Fundamentals of Clinical Trial Management (Saukkonen, Lata)

Credits 2
Spring I

This course introduces key principles and practical applications for the development of new pharmaceutical compounds. It will 1) introduce the student to the total clinical research process from the perspective of the current Good Laboratory Practices (GLP) and the current Good Clinical Practices (GCP), including specific global regulatory guidelines frame-working the development and approval of new pharmaceuticals; 2) focus on the responsibilities and effective interactions between the investigating research site and the various regulatory entities charged with ensuring the protection of the human research subject as well as the overall integrity of the clinical trial and the sponsor; 3) ensure that the student will be able to relate "real world" experiences and techniques to regulatory requirements, necessary to effectively prepare for and conduct a variety of clinical trials from the perspective of the investigator and sponsor.

GC 650 Pharmacoeconomics (Nash, Lofland)

Credits 3
Spring I

This course provides a thorough introduction to the field of pharmacoeconomics and disease management. Beginning with the basics such as reasons for study, the challenges facing experts, and the significance of the science, the course will propel students through the practical knowledge necessary to embark on current, valid, comprehensive studies. Cost benefit, cost utility, cost effectiveness methods will be defined in detail. Accounting and finance will be integrated with statistics and database skills. Students will learn how to use available technology to their advantage and will gain hands-on experience by conducting case studies of their own. In addition, the course includes a general introduction to managed care, including all relevant terminology, government institutions, current public policy, and varying viewpoints of experts in the field.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

GC 670 Experimental Design in Research (Diamond)

Credits 2
Prerequisite: GC 660 or permission of instructor
Spring II

The purpose of this course is to have students apply the principles and techniques of basic statistical analysis specifically to development of clinical research protocols. Lecture and workshop sessions will be used to gain an in-depth understanding of the issues relating to experimental design and conduct.

GC 680 Laboratory Techniques in Molecular Biology (Buescher, Kuo)

Credits 2
Maximum number of students 16
Fall, Spring II

The purpose of the course is to introduce the students to basic techniques in molecular biology, including genetic engineering. Beginning with an introduction to the biological significance of DNA and the fundamentals of good laboratory practices, students will become familiar with: purification and characterization of nucleic acids; cloning vectors, enzymes used in DNA cloning, and *E. coli* host strains; principles of restriction mapping, recombinant library construction, and the polymerase chain reaction; production and use of nucleic acid probes in

hybridization to filter-immobilized DNA. Students will be instructed in the biochemical and biological concepts involved in the selected molecular biology techniques so that, at the completion of the course, students will have the ability to work through technical problems in this "kit-oriented" era, and to assimilate new techniques as they arise.

GC 690 Regulatory Issues in Scientific Research (Smith)

Credits 2
Spring II

The course is designed to familiarize students with regulations governing scientific research, specifically research involving human subjects. Lectures and discussions will focus on the history of regulations governing human subject research, regulations protecting human research subjects, regulations concerning the development of new drugs and devices, and regulations dealing with the use of ionizing radiation, isotopes, recombinant DNA, and gene therapy.

GC 720 Scientific Writing (Buescher, Dohm)

Credits 2
Summer

This course concentrates on the process of writing the dissertation/thesis or research paper and on the effective presentation of scientific information. Students will learn to write the sections of a research paper or thesis and will develop skills with various pieces of productivity software such as word processors, spreadsheets and statistical packages. Students will learn how to create sophisticated documents to improve communication of scientific information. The course emphasizes a reader-oriented approach to writing, critical analysis of good biomedical writing, and strong presentation of data and ideas. Some time will also be spent on principles of effective oral presentations.

ID 517 Introduction to Pharmacology (Pendelton)

Credits 3

Presents an overview and synthesis of the basic mechanisms of drug action and the way in which drugs interact with biological tissue. Emphasizes drug receptors, agonists, and antagonists and the predictability of many drug actions and side effects. It covers areas such as: routes of administration, absorption, distribution and elimination, receptor theory, the nervous system, and each major class of drugs.

IM 505 Fundamentals of Immunology (Korngold, et al.)

Credits 4
Permission of instructor required
Fall

A comprehensive course encompassing the major areas of Immunology: 1) the cells and organs of the immune system; 2) nature of antigens, antibodies, and receptors; 3) lymphocyte activation, proliferation, and differentiation; 4) the major histocompatibility complex; 5) regulation of the immune response; 6) effector mechanisms of immunity; and 7) immunologic mechanisms in disease. The format will involve both lecture and discussion of specific topics, and students will be encouraged to acquire an understanding of classical and modern immunological concepts through analysis of their experimental bases. Discussion of critical techniques in Immunology will be incorporated throughout the course. Assigned reading.

MI 521* Introduction to Immunology (J. Buescher)

Credits 2
Fall

The course introduces the students to the immune system as an adaptive defense system that recognizes invading pathogenic organisms and mounts a response to eliminate or neutralize foreign infectious agents. The students will be introduced to the molecules, the cells, and organs, and the processes involved in host defense against infection. An overview of basic principles, concepts, and techniques used to assess immune status will be presented.

MI 580 Principles of Epidemiology (G. Buescher, Robbins)

Credits 2
Spring II

This course will present the science of epidemiology using examples from the whole field of pubic health. Beginning with the basic concepts the course will include examples of the broad range of modern applications of epidemiology. Students will become familiar with the role of epidemiology as applied in environmental/occupational medicine, pharmaceuticals, health outcomes research, infectious diseases and cancer care.

PA 570 Pathologic Aspects of Disease (Fenderson)

Credits 3
Summer

The course will cover topics in general and systemic pathology, providing an overview of major aspects of human pathology and the pathophysiology of major diseases. Lectures supplemented with computer module containing case studies, clinical correlations and self-assessment components.

PR 530 Fundamentals of Biosafety (Grunwald, Souder)

Credits 2
Spring I

The purpose of this course is to provide students with a basic knowledge of biosafety as related to good laboratory practice. The course will begin with an introduction to Federal biosafety regulations, guidelines and standards, the role of the Biological Safety Officer in the institution and the epidemiology of laboratory-associated infections. Students will become familiar with: concepts in biotechnology and cell biology; means of exposure to biohazardous agents; hazard assessment in the laboratory; laboratory design criteria when using biohazardous agents; good laboratory practice, (GLP); decontamination, sterilization, disinfection and proper disposal of infectious waste; packaging and shipping of biohazardous material; biosafety training design and implementation; and special considerations related to gene therapy.

PR 625 Animal Pharmacology (Barone, Landi)

Credits 3
Fall

This course provides basic training for M.S. and Ph.D. students in animal pharmacology. The specific goals of the course are: 1) to provide basic principles of *in vivo* drug experimentation conducted on anesthetized and conscious animals. Principles of animal anesthesia, surgical procedures, pre- and post-operative care will be studied along with regulatory and ethical aspects of experimentation on small and large laboratory animals; 2) to provide basic knowledge and insights on animal models of human disease and the scientific and technical issues associated with the use of laboratory animals in drug development. Principles of pharmacodynamics and pharmacokinetics will be introduced, along with major organ and systemic pharmacology of the heart, kidney, brain, blood vessels, and the pulmonary system; 3) to provide an opportunity to acquaint students with modern pharmacology research in an industrial set-up and the fundamentals of the processes of drug discovery.

PR 630 General Toxicology (Middleberg)

Credits 3
Summer

This course will introduce students to the principles and practices of Toxicology. Emphasis will be given to the comprehensiveness of toxicology as opposed to individual academic interests. While introductory courses in biochemistry, physiology, anatomy, and pharmacology would be helpful, they are not necessary since each topic will be covered as an introduction to the subject matter.

*Required core courses.

Master of Science Program in Developmental Biology and Teratology

Program objectives: The graduate studies program leading to the Master of Science degree in Developmental Biology and Teratology is offered by the Department of Pathology, Anatomy, and Cell Biology through the College of Graduate Studies of Thomas Jefferson University. As a component of our nationally recognized Graduate Training Program in Developmental Biology and Teratology, the objective of this master's program is the training of individuals in the theoretical, experimental, and practical aspects of normal and abnormal developmental biology. The program provides post-baccalaureate training for students who wish to pursue a career in education, research, government or industry where in-depth knowledge of developmental biological principles is required. Recent developments in academia and in biomedical industrial settings indicate a growing need and significant career opportunities for individuals trained at the M.S. level. Examples of such careers where a background in developmental biology and teratology is needed include college and professional school instructors in anatomy and embryology; medical illustrators; researchers in university, government, or industrial developmental biology or teratology laboratories; and related government regulatory agencies. The program is also appropriate for students preparing for advanced professional degree programs in biology or medicine.

Program organization: The curriculum consists of a 40-credit hour program including core courses in developmental biology and teratology, related electives appropriate to students' individual interests, and supervised laboratory thesis research. An attractive feature of the program is the wide variety of elective courses available to tailor the program to individual career goals of the students. These elective courses cover subjects of cell and molecular biology, toxicology, organizational developmental and management, research ethics, statistical analysis, and research design and methods. Students also attend a series of seminars which highlight current research in developmental biology and teratology. Following consultation with the program faculty, each student selects a laboratory in which he/she conducts a scholarly research project under supervision of a faculty mentor, culminating in the writing of a Master's Research Thesis. Flexibility built into the program makes it accessible to students who may wish to enroll on a part-time or full-time basis. A full-time student could complete the program in two years, while a part-time student will require a length of time corresponding to his/her per-semester enrollment credits.

Applicant requirements: Applicants to the program must possess a baccalaureate degree in chemistry, biology, or a related discipline from an accredited institution, and meet the general admissions requirements of the College of Graduate Studies. These requirements include submission of scores on the verbal, quantitative, and analytical components of the Graduate Record Examination, as well as three letters of reference, and the undergraduate scholastic record. The program is designed to accommodate both full-time and part-time students, and thus part-time students may simultaneously maintain full-time employment and be eligible for employer tuition reimbursement programs.

Program Requirements

Required Courses (18 credits)

		Credits
DB 615	Developmental Biology and Teratology I: Embryology	3
DB 625	Developmental Biology and Teratology II: Mechanisms of Development	3
DB 635	Developmental Biology and Teratology III: Mechanisms of Teratogenesis	3
BI 550	Topics in Medical Biochemistry	3
GC 660	Statistical Methods for Data Analysis	2
DB 710,720,730	Seminar	1
DB 810,820,830	Laboratory Clerkship	6
DB 870, 880, 890	Master's Thesis Research	6

Recommended Elective Courses (22 credits)

PR 630	General Toxicology	3
PA 510	Concepts in Cell Biology	3
GC 700	Introduction to Neuroscience	3
DB 616,626,636	Current Topics in Developmental Biology I, II, III	1 each
DB 705	Developmental Neurobiology	3
DB 715	Selected Topics in Neurosciences	2
DB 745	Developmental and Reproductive Toxicology	3
GC 529	Laboratory Animal Sciences	2
GC 640	Research Ethics: The Responsible Conduct of Research	1
GC 670	Experimental Design in Research	2
GC 720	Scientific Writing	2
ID 515	Neurobiology and Endocrinology	3
ID 530	Neurosciences	8
PA 570	Pathologic Aspects of Disease	3
PR 513	Introduction to Pharmacology	3
PR 530	Fundamentals of Biosafety	1
PR 625	Animal Pharmacology	3

Management Courses:

GC 525	Information Systems in Organization	3
GC 600	Management Skills	3
GC 605	Performance Improvement	2
GC 610	Strategic Management	3
GC 615	Grant Management	2
GC 620	Fundamentals of Financial Management	3
GC 621	Biotechnology Venture Management	2

Graduate Faculty

Professors

DAVID E. BIRK, Ph.D., Wayne State, 1981: Developmental biology of extracellular matrix assembly in tendons and the cornea; mechanisms regulating collagen fibrillogenesis and tissue-specific fiber formation.

RONALD A. COSS, B.A., Ph.D., University of Colorado, 1974: Cell biology: radiation biology; cell cycle, mitosis, and cytokinesis; nuclear matrix and cytomatrix; heat shock of cells in culture; determination of critical cellular structures whose modification by heat shock results in cell death.

LEONARD M. EISENMAN, B.A., M.A., Ph.D., Duke University, 1974: Neuroscience; anatomical, developmental and functional studies of the organization of the cerebellum; the normal and abnormal development of this structure analyzed with the use of rodents and neurologically mutant mice; the special emphasis give to the development of the topographic and synaptic organization of afferent systems to the cerebellum.

GERALD B. GRUNWALD, B.A., M.S., Ph.D., University of Wisconsin, 1981, Associate Dean CGS, Director of Graduate Program in Developmental Biology and Teratology; Developmental biology, neuroscience; analysis of cell-cell interactions during development of the nervous system and the eye; studies of regulation of cadherin cell adhesion molecule expression and function in development and disease using biochemical, cell biological, immunological and molecular genetic methods.

JAN B. HOEK, Ph.D., University of Amsterdam, 1972: Director of Graduate Program in Pathology and Cell Biology; Cellular aspects of hormonal regulation and its disturbance in response to acute and chronic alcohol treatment; the regulation of cellular calcium homeostasis; the role of calcium in intracellular transduction of hormonal signals; the regulation of phosphoinositide-linked signal transduction system; mitochondrial function and control of cellular energy conservation.

LORRAINE IACOVITTI, Ph.D., Cornell, 1979: Developmental biology and neuroscience; mechanisms of neuronal cell differentiation and development of neurotransmitter class; application of immortalized stem cells to treat neurodegenrative diseases such as Parkinson's and Alzheimer's.

RONALD P. JENSH, B.A., M.A., Ph.D., Jefferson Medical College, 1966: Teratology; postnatal effects of prenatal exposure; studies of low level exposure to X-irradiation, ultrasound, and exposure to vitamin A and their effects on postnatal growth; reflex acquisition; physiologic development and learning in neonates and adult offspring.

SURESH K. JOSEPH, B.Sc., Ph.D., University of Bristol, 1978: Structure, function, and regulation of the inositol trisphosphate receptor (IP3R); biosynthesis and assembly of IP3R homo- and heterooligomers; mechanisms of proteasomal and lysosomal degradation of IP3R. Alcohol research; calcium metabolism; cell biology; membrane biology, receptors and signal transduction.

HIDEKO KAJI, B.S., M.S., Ph.D., Purdue University, 1958: Regulatory biochemical mechanisms of macromolecular synthesis; biochemical pharmacology on human anti-retroviral drugs.

THOMAS B. KNUDSEN, B.S., Ph.D., Thomas Jefferson University, 1981: Developmental biology and teratology; mitochondrial mechanisms of teratogenesis; genomic basis of differential teratogen susceptibility; programmed cell death in the early embryo.

DEVENDRA M. KOCHHAR, B.Sc., M.Sc., Ph.D., University of Florida, 1964: Developmental biology/teratology; molecular events associated with limb dysmorphogenesis and chondrogenesis; biosynthesis of extracellular components such as collagen analyzed as affected by certain genetic mutations; role of retinoid receptors in the embryo.

BARBARA P. SCHICK, B.A., Ph.D., Bryn Mawr College, 1979: Regulation of gene expression and biosynthesis of proteoglycans in hematopoietic and non-hematopoietic cells during cell development; functional aspects of the intracellular and secreted proteoglycans.

RICHARD R. SCHMIDT, B.A., Ph.D., Medical College of Wisconsin, 1975: Developmental immunology and developmental toxicity of the mammalian immune system; the arachidonic acid cascade and its relationship to in vitro growth and differentiation of the fetal murine thymus.

DAVID S. STRAYER, M.D., Ph.D., Chicago. Genetic determinants of viral virulence and virus interaction with infected cells; regulation of pulmonary surfactant secretion and of surfactant protein gene expression; role of epidermal growth factor and like cytokines in oncogenesis; regulation of cell division.

ROCKY S. TUAN, B.A., M.A., Ph.D., Rockefeller University, 1977: Cell and molecular biology of skeletal development, growth, and disease; bone-biomaterial interaction and implant design; tissue engineering of bone and cartilage; confocal laser imaging of cells and extracellular matrix; animal models of skeletal diseases; molecular, gene-based infection diagnostics. Cellular molecular mechanisms regulating calcium metabolism and calcium-mediated functions during embryonic development, placental calcium transport, gene expression of embryo-specific calcium-binding proteins, limb chondrogenesis and embryonic skeletogenesis.

JOUNI UITTO, M.D., Ph.D., University of Helsinki, 1970: Biochemistry and molecular biology of connective tissue, in relation to cutaneous diseases. Molecular genetics of the cutaneous base membrane zone; regulation of collagen and elastin gene expression, with emphasis on pharmacologic modulation; molecular basis of heritable and acquired connective-tissue diseases, mechanisms of cutaneous aging with development of strategies to prevent reverse age-associated connective-tissue alterations.

Associate Professors

MANUEL L. COVARRUBIAS, M.Sc., M.D., Ph.D., National University of Mexico, 1977; Ph.D., National University of Mexico, 1980: Molecular mechanisms that regulate the function of cloned voltage-sensitive potassium channels; recombinant DNA techniques (e.g. in vitro mutagenesis) and electrophysiological recording (e.g. patch-clamp recording) used to study the structure-function relation; the action of protein kinases, regulation of channel gating, and the action of ethanol and general anesthetics.

BRUCE A. FENDERSON, B.S., Ph.D., Johns Hopkins University, 1980: Mechanisms of morphogenesis and malignancy; role of cell surface carbohydrates in developmental processes and differentiation; the glycolipids of human germ cell tumors and the role of hyaluronan in regulating cell migration.

KIRK M. MCHUGH, B.S., Ph.D., University of Cincinnati College of Medicine, 1986: Molecular biology; molecular genetics of isoactin gene expression during mammalian development; development of gastrointestinal smooth muscle utilizing a variety of molecular and cellular techniques.

A. SUE MENKO, B.A., Ph.D., University of Pennsylvania, 1978: The role of integrins in the regulation of cell differentiation; current studies focus on integrin signaling of cell differentiation events, particularly integrin-growth factor receptor coordinated signaling.

NANCY J. PHILIP, Ph.D., Wayne State, 1981: Cellular and developmental biology; developmental regulation of transport proteins and metabolism in the retina and retinal pigment epithelium.

ELIZABETH J. VAN BOCKSTAELE, Ph.D., NYU, 1991: Neuroscience; neuroanatomy and neurophysiology of catecholaminergic brain nuclei involved in drug addiction and withdrawal mechanisms; mechanisms of stress and control of autonomic processes.

Research Associate Professor

PAMELA A. NORTON, Ph.D., Tufts University, 1986: Molecular and cellular regulation of the extracellular matrix protein fibronectin during embryonic limb development; mechanisms of transcriptional regulation of extracellular matrix genes in liver and roles in the pathogenesis of chronic hepatitis B virus infection.

Assistant Professors

JAMES B. JAYNES, B.S., Ph.D., University of Washington (Seattle), 1987: Developmental biology and genetics; transcription of factor interactions during development of *Drosophila*; genetic control of pattern formation.

ALEXANDER MAZO, Ph.D., Institute of Molecular Biology, Academy of the Sciences of the USSR, 1986: *Drosophila* developmental genetics; regulation of homeotic genes.

JOY MULHOLLAND, B.A., M.S., A.M., Ph.D., Harvard University, 1983: Steroid hormone regulation of gene expression in the female reproductive tract; molecular causes of infertility, induction of uterine adenocarcinoma, regulation of epithelial cell polarity, biological effects of microgravity.

Course Descriptions

DB 615* Developmental Biology and Teratology I: Embryology (McHugh)

Credits 3
Fall

Embryogenesis encompasses development of an organism from fertilization to birth. DB 615 will describe the fundamental and historical concepts of morphogenesis and cell differentiation as they pertain to the early embryo, body axis formation, and development and maturation of the major organ systems, including the placenta. Emphasis will be placed on comprehensive descriptions of developmental systems.

DB 625* Developmental Biology and Teratology II: Mechanisms of Development (Grunwald)

Credits 3
Prerequisite: DB 615 or equivalent
Spring I

This course will examine specific developmental events in detail, emphasizing contemporary concepts in cellular regulation, growth and pattern formation, differential gene expression, and cell death. Lectures and problem-based discussion groups will explore the rationale behind experimental design as it pertains to investigating principal mechanisms directing normal embryogenesis.

DB 635* Developmental Biology and Teratology III: Mechanisms of Teratogenesis (Knudsen)

Credits 3
Prerequisites: DB 615, 625 or permission of the instructor
Spring II

Teratology is the study of birth defects and their causes and includes investigations pertaining to both structural and functional abnormalities. About 2-3% of live-born infants have detectable congenital malformations at birth; the incidence often doubles by the end of the first year of life due to the discovery of abnormalities which were indiscernible at birth. These figures still do not account for intrauterine growth retardation and prenatal deaths. Like carcinogenesis, teratogenesis involves complex interactions between the genome and environment of an individual. DB 635 will explore these interactions as they pertain to the pregnant mother and fetus, integrating information regarding causal signals of abnormal development, the transduction of these signals into a teratogenic lesion, and the genes which are likely to be determining factors in abnormal embryonic development. It will also encompass a unit on applied teratology from the perspective of pharmaceutical testing to determine how human teratogens are discovered.

DB 705 Developmental Neurobiology (Grunwald)

Credits 3
Prerequisite: AN 530 or equivalent
Fall

Survey course of major investigative lines that developmental neurobiologists follow in order to study how the nervous system develops. Topics include: neural tube formation; neural crest migration; proliferation and migration of neurons and glia; neuronal determination; cell death; synaptogenesis.

DB 715 Selected Topics in Neurosciences (Van Bockstaele)

Credits 2

Lectures and discussion groups dealing with selected literature topics of current interest.

DB 745 Developmental Toxicology (Knudsen)

Credits 3
Prerequisite: PR 630 or equivalent

In-depth analysis of endpoint assays for measuring adverse effects of environmental agents on developmental parameters. Selected readings from contemporary scientific literature will serve as didactic and colloquial foci for discussions. Topics include: effects on male and female reproduction and the conceptus; multigenerational effects; thresholds of effect; quantitative risk estimation; generic application of safety factors; impact of regulatory actions in the workplace.

DB 810,820,830* Laboratory Clerkship (Grunwald, G. Buescher)

Credits 1-6

To gain experience and proficiency in the clinical and/or research application of developmental biology and teratology, students will become familiar with state-of-the-art instrumentation and specialized research techniques through placement in a clinical or research laboratory of the University or in an affiliate institution. The type of laboratory and duration of training for this experience will vary depending upon the student's prior experience, needs, and career goals.

DB 870,880,890 Master's Thesis Research (Grunwald, G. Buescher)

Credits 1-6

Laboratory investigation culminating in a written Master's research thesis. Students, working under the supervision of a research advisor, will formulate research questions, record, and analyze the research data. Presentation of completed research will be made by students prior to graduation.

BI 550* Topics in Medical Biochemistry (Allen)

Credits 3
Fall

This lecture course presents the standard topics of biochemistry and molecular biology. In addition, emphasis is placed on explaining how certain abnormal

biochemical events can account for the development of certain diseases. The course also provides useful background material for some of the subsequent courses taken in the Master of Science programs in the basic sciences.

GC 525 Information Management (Bross)

Credits 3
Maximum number of students 15
Fall, Spring II

This course is designed to provide a detailed understanding of information systems and their use within the modern organization. It will explore the essential components of the systems and analyze how each is developed and linked into a production system. Contemporary computing concepts will be examined and a profile of strategic information management issues will be presented. Particular emphasis will be placed on the role of technology in assisting organizations to meet their operational and strategic goals. The course incorporates Internet activities, spreadsheets, and a database management package.

GC 600 Management Skills (G. Buescher, Arsenault)

Credits 3
Maximum number of students 25
Fall

This course introduces current theories and concepts of leadership and management and develops the skills necessary to successfully perform as a manager and leader. Based on input from focus groups with representatives from the pharmaceutical, biotechnology and healthcare industries, the course gives special emphasis to developing skills for collaboration, improved communication, problem solving, managing change, and reengineering.

GC 610 Strategic Management (Buescher, D'Arville)

Credits 3
Spring II

This course introduces the student to the Strategic Management Process as a base, to build on the basic management skills that the student has developed to date. The student will learn the nature and importance of planning; develop a "plan" for planning; relate planning to change management; and outline, investigate, and use the strategic management process. The student will learn to perform a situational audit, formulate program strategies and long and medium-range objectives, and learn the steps in strategic implementation.

GC 620 Fundamentals of Financial Management (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Spring I

The purpose of this course is to introduce the non-financial manager to financial systems, principles of accounting and their relationship to basic business activ-

ities. These concepts will be relevant to the research laboratory and discussion will center on basic financial statements and their analysis, financial planning, business language, and concepts, preparation and interpretation of financial statements. The use of electronic worksheets will also be incorporated in the analysis of case studies.

GC 650 Pharmacoeconomics (Nash, Lofland)

Credits 3
Spring I

This course provides a thorough introduction to the field of pharmacoeconomics and disease management. Beginning with the basics such as reasons for study, the challenges facing experts, and the significance of the science, the course will propel students through the practical knowledge necessary to embark on current, valid, comprehensive studies. Cost benefit, cost utility, cost effectiveness methods will be defined in detail. Accounting and finance will be integrated with statistics and database skills. Students will learn how to use available technology to their advantage and will gain hands-on experience by conducting case studies of their own. In addition, the course includes a general introduction to managed care, including all relevant terminology, government institutions, current public policy, and varying viewpoints of experts in the field.

GC 670 Experimental Design in Research (Diamond)

Credits 2
Prerequisite: GC 660 or permission of instructor
Spring II

The purpose of this course is to have students apply the principles and techniques of basic statistical analysis specifically to development of clinical research protocols. Lecture and workshop sessions will be used to gain an in-depth understanding of the issues relating to experimental design and conduct.

GC 680 Laboratory Techniques in Molecular Biology (Buescher, Kuo)

Credits 2
Maximum number of students 16
Fall, Spring II

The purpose of the course is to introduce the students to basic techniques in molecular biology, including genetic engineering. Beginning with an introduction to the biological significance of DNA and the fundamentals of good laboratory practices, students will become familiar with: purification and characterization of nucleic acids; cloning vectors, enzymes used in DNA cloning, and *E. coli* host strains; principles of restriction mapping, recombinant library construction, and the polymerase chain reaction; production and use of nucleic acid probes in hybridization to filter-immobilized DNA. Students will be instructed in the biochemical and biological concepts involved in the selected molecular biology techniques so that, at the completion of the course, students will have the ability to work through technical problems in this “kit-oriented” era, and to assimilate new techniques as they arise.

GC 700 Introduction to Neuroscience (Grunwald, Horn)

Credits 3
Fall

Introduction to Neuroscience is a graduate lecture/seminar survey course which is designed to introduce students to basic concepts and experimental approaches to issues in the neurosciences. The course is divided into two integrated sections focusing on 1) Neurophysiology and Synaptic Transmission and 2) Neuroanatomy and Systems. An interdepartmental team of faculty will lead students through these topics with a series of lectures and discussions based upon assigned text readings and current journal articles.

GC 720 Scientific Writing (Buescher, Dohm)

Credits 2
Summer

This course concentrates on the process of writing the dissertation/thesis or research paper and on the effective presentation of scientific information. Students will learn to write the sections of a research paper or thesis and will develop skills with various pieces of productivity software such as word processors, spreadsheets and statistical packages. Students will learn how to create sophisticated documents to improve communication of scientific information. The course emphasizes a reader-oriented approach to writing, critical analysis of good biomedical writing, and strong presentation of data and ideas. Some time will also be spent on principles of effective oral presentations.

PA 510 Concepts in Cell Biology (Hoek, et al.)

Credits 3
Fall

An overview is provided of structure-function relationships in mammalian cells and subcellular structures.

PR 630 General Toxicology (Middleberg)

Credits 3
Summer

This course will introduce students to the principles and practices of Toxicology. Emphasis will be given to the comprehensiveness of toxicology as opposed to individual academic interests. While introductory courses in biochemistry, physiology, anatomy, and pharmacology would be helpful, they are not necessary since each topic will be covered as an introduction to the subject matter.

*Required core courses.

Master of Science Program in Laboratory Sciences

Clinical and research laboratories develop and utilize increasingly sophisticated technical and information systems to provide accurate and reliable diagnostic and therapeutic products. At the same time, the healthcare climate in which laboratories provide these services necessitates meticulous attention to the integrity of the research process, and to quality assurance including patient outcomes of laboratory testing, regulatory compliance, and human and financial resources management. The laboratory industry seeks individuals who possess these value-added skills in addition to their exceptional technological skills for clinical and research laboratory practice and management.

The Master of Science in Laboratory Sciences (MSLS) Program prepares students in the laboratory fields of biotechnology, cytotechnology and medical technology who will

- make lasting contributions to health sciences and health care through clinical laboratory leadership and research exploration;
- address critical management, quality assurance, operational, financial and research study issues in clinical or research laboratories; and
- participate in collaborative educational and research opportunities with faculty, students and laboratory practitioners.

The combined MSLS Program is designed for students who have completed a minimum of 82 semester credits, including 36 credits in biological and chemical sciences. The MSLS program enables students to qualify for admission to graduate laboratory sciences education at Thomas Jefferson University through a combined BSLS/MSLS program. The goal of the program is to provide a mechanism for students to earn the BSLS and the MSLS degrees in a seamless integrated curriculum. At the conclusion of the program, the BSLS and MSLS degrees are awarded.

Students entering the Graduate Phase only begin the program in the Summer Session, and earn the MSLS degree at the conclusion of the program.

Program Accreditation

The Biotechnology Program is approved by the University administration. The program in Cytotechnology is fully accredited by the Commission on Accreditation of Allied Health Education Programs (CAAHEP) in collaboration with the American Society of Cytopathology. The program in Medical Technology is fully accredited by The National Accrediting Agency for Clinical Laboratory Sciences (NAACLS).

Admission Requirements

Applicants meeting the following requirements will be considered for admission to the combined degree program:

1. Two letters of recommendation (at least one from a science professor).
2. Cumulative GPA of at least 2.8 (on a 4.0 scale) for all undergraduate courses, with a 3.0 in science courses.
3. Personal statement.
4. An English proficiency examination may be required of applicants whose native language is not English. A minimum score of 550 (written exam) or 207-220 (computerized exam) is recommended on the Test of English as a Foreign Language (TOEFL).
5. International Students must obtain an evaluation of foreign transcripts by the World Education Service (WES) or comparable agency.
6. A personal interview, when requested.

Applicants to the combined degree program will complete the standard College of Health Professions admission form. Additional information about the BSLS/MSLS admissions process, including transfer course distribution requirements, may be obtained by contacting:

Office of Admissions and Enrollment Management
College of Health Professions
Thomas Jefferson University
130 South 9th Street, Suite 1610
Philadelphia, PA 19107-5233
Toll-free: 877-JEFF-CHP (877-533-3247)
Local: 215-503-8890
Web site: www.tju.edu/chp

Admission Requirements for the Graduate Phase **only** of the Master of Science Program:

1. a. Official academic transcripts (two copies) of all undergraduate coursework culminating in a baccalaureate degree in a Laboratory Sciences field of Biotechnology, Cytotechnology or Medical Technology

   or

   b. Official academic transcripts (two copies) of all undergraduate coursework culminating in a baccalaureate degree *and* official academic transcripts (two copies) indicating completion of a certificate program in Biotechnology, Cytotechnology or Medical Technology.
2. The required transfer credit distribution.
3. A minimum GPA of 3.0 (on a 4.0 scale) earned at the baccalaureate level.
4. Three (3) letters of recommendation.
5. The Test of English as a Foreign Language (TOEFL) is required for students whose first language is not English.

6. International Students must obtain an evaluation of foreign transcripts by the World Education Service (WES) or comparable agency.
7. Acceptable performance on the Graduate Record Examination.
8. A personal interview, when requested.

Applicants to the Graduate Phase only will complete the standard College of Graduate Studies admission form. Additional information about the Graduate Phase admission process may be obtained by contacting:

Director of Admissions
College of Graduate Studies
Thomas Jefferson University
1020 Locust Street, M-46
Philadelphia, PA 19107

Telephone: 215-503-4400
Fax: 215-503-3433
Email: jessie.pervall@mail.tju.edu

Curriculum

The combined Master of Science in Laboratory Sciences Program is a 2-year, full-time sequence, including summer terms. The first year of the MSLS sequence consists of predominantly undergraduate coursework in Biotechnology, Cytotechnology or Medical Technology. Students who achieve a grade-point average of 3.0 or higher at the completion of two semesters of undergraduate coursework are admitted to the graduate phase of the program. In the graduate phase of the program, students complete required basic science, research, practicum and elective coursework. Students will also complete coursework in a selected concentration area of Management & Supervision; Financial Management; Research Skills; or Regulatory & Quality Management.

Total Transfer/Lower Division Credits	**82**
Total Undergraduate Phase Credits	**38**
Total Graduate Phase Credits	**37**
Total Credits:	**157**

Program Specific Undergraduate Requirements:

The Biotechnology, Cytotechnology and Medical Technology programs have different curricula at the Undergraduate level. A complete curriculum listing for each program option can be found in the College of Health Professions Catalog; on-line at www.tju.edu/laboratory-sciences; or by contacting the College of Health Professions' Office of Admissions and Enrollment Management.

MSLS Required Courses		**Credits**
LS 603	Research Design	3
LS 801	Research Project I	1
LS 802	Research Project II	2
LS 812	Practicum I	2
LS 813	Practicum II	2

LS 814	Practicum III	2
LS 815	Practicum IV	2
BI 550	Topics in Medical Biochemistry	3
GC 720	Scientific Writing	2
ID 527	Statistics, Epidemiology & Inference	3
PA 570	Pathologic Aspects of Disease	3
Concentration		9
Graduate Elective		6

Concentration Areas

Each student in the graduate phase of the MSLS program selects one of four available areas of Concentration. Concentration Areas focus on and reflect contemporary areas of clinical and research laboratory management, administration and advanced practice.

Management & Supervision (9 credits)

LS 610	Regulatory and Fiscal Issues in Laboratory Management	3
LS 620	Laboratory Information Systems (LIS) Management	3
GC 525	Information Systems in Organizations	3
GC 600	Management Skills	3
GC 610	Strategic Management	3
ID 512	Healthcare Law	3
ID 513	Managing People	3
ID 514	Organization Development	3
ID 518	Health Care Issues: Quality & Cost	1
ID 580	Providing Community Consultation in Health Care	3
ID 589	Human Services Techniques	3
ID 627	Approaches to Management and Supervision	3

Financial Management (9 credits)

LS 610	Regulatory and Fiscal Issues in Laboratory Management	3
LS 620	Laboratory Information Systems (LIS) Management	3
GC 650	Pharmacoeconomics	3
ID 512	Healthcare Law	3
ID 518	Health Care Issues: Quality & Cost	1
ID 522	Marketing Health Care Services and Programs	3
ID 526	Accounting & Finance for Managers	3
ID 540	Launching New Ventures: An Entrepreneurial Approach	3
ID 570	Financial Management in Health Care Organizations	3

Research Skills		(9 credits)
GC 630	Fundamentals of Clinical Trials	3
GC 635	Fundamentals of Clinical Trial Management	2
GC 640	Research Ethics	1
GC 660	Statistical Methods for Data Analysis	2
GC 670	Experimental Design in Research	2
ID 512	Healthcare Law	3
ID 595	Ethics and Research in the Health Professions	3
ID 660	Regulatory Issues in Scientific Research	2
PR 530	Biosafety	1
LS 630	Laboratory Services Research Techniques	3
Regulatory and Quality Management		(9 credits)
LS 610	Regulatory and Fiscal Issues in Laboratory Management	3
LS 620	Laboratory Information Systems (LIS) Management	3
GC 625	Drug Development Issues	2
GC 630	Fundamentals of Clinical Trials	3
GC 635	Fundamentals of Clinical Trial Management	2
GC 640	Research Ethics	1
GC 650	Pharmacoeconomics	3
ID 512	Healthcare Law	3
ID 660	Regulatory Issues in Scientific Research	2
MI 580	Principles of Epidemiology	2
PR 530	Fundamentals of Biosafety	1

Graduate Faculty

Professor

SHIRLEY E. GREENING, C.F.I.A.C., M.S., J.D., Temple University School of Law, 1989: Chair of the Department; laboratory practice standards and outcomes; professional liability and regulation; cytopathology.

Assistant Professors

INDRA BALACHANDRAN, C.M.I.A.C., M.S., Ph.D., Syracuse University, 1994: Cytopathology; computer adapted instruction; automated cytopreparation and screening technology.

ESTHER E. BISWAS, M.S., Ph.D., University of Medicine and Dentistry of New Jersey-Rutgers, 1999: ATP hydrolysis; DNA helicases; DNA polymerases; genetic mutations in visual diseases.

Course Descriptions

Graduate Program – Laboratory Sciences (LS) Courses

Refer to other sections of the College of Graduate Studies *Catalog* for graduate required or elective courses prefixed as ID, PA, GC, BI, PR or MI. Refer to the College of Health Professions *Catalog* for 300 and 400 level courses (undergraduate courses prefixed as LS, BT, CT, MB or MT).

LS 603 Research Design (Biswas)

Credits 3
Fall

Emphasis is placed on the acquisition of methods and techniques for extending the scientific base of knowledge for laboratory practice. Research studies which address questions of impact on laboratory science and which are drawn from an interdisciplinary health perspective, serve as the focus for discussion. Research designs and related statistical processes are examined in terms of their appropriateness for addressing various laboratory practice problems. (Cross-listed with NU 603, OT 603, PT 603)

LS 610 Regulatory and Fiscal Issues in Laboratory Management (Greening)

Credits 3
Fall, starting 2002

Study and application of regulatory and fiscal requirements for laboratory operations. Federal, State and local requirements governing clinical and research laboratories; compliance issues; billing and reporting requirements for laboratories using private, managed care and other third party payors (including federal government programs). Current procedural terminology used to assign and bill for laboratory procedures. Budgeting for laboratory operations.

LS 620 Laboratory Information Systems Management (Balachandran)

Credits 3
Spring

Design and use of information systems for clinical, anatomic and research laboratories. Vendor demonstrations, hands-on practice and trouble-shooting of data protocol development, input and retrieval to produce useful information for laboratory operations.

LS 630 Laboratory Services Research Techniques (Greening)

Credits 3
Spring

Overview of the various techniques and resources used to influence and measure performance improvement, proper test utilization and best practices as strategies to improve the effectiveness of patient care. Students examine the relevant literature and develop instruments to assess the laboratory's role in cost-effectiveness, access to laboratory testing and quality of laboratory testing.

LS 801, 802 Research Project I, II (Biswas)

Credits 1, 2
LS 801 - Fall
LS 802 - Spring

Research using the various techniques and resources available to measure performance improvement, test utilization, best practices and/or clinical outcomes. Students assess the laboratory's role in cost-effectiveness, access to laboratory testing and/or quality of laboratory methods. A written paper and oral presentation are required at the conclusion of the project.

LS 812, 813, 814, 815 Laboratory Sciences Practica I, II, III, IV (Balachandran)

Credits 2 each course
Fall, Spring I, Spring II, Summer

Internships in affiliated laboratories. Students rotate through all phases of laboratory work and functions. Components include practical work experience, participation in and/or observation of specialty area(s), quality assurance and continuing education activities, seminar attendance, and adjunct technologies.

Master of Science Program in Microbiology

The program provides a broad-based curriculum reflecting the emergence of biotechnology and rapid technological development to prepare microbiologists for positions of leadership. There are three areas of specialization: (1) clinical microbiology, (2) microbiology research/bio-technology, and (3) infection control. Graduates of the program are employed as managers of clinical laboratories, infection control practitioners, epidemiologists, clinical trial coordinators, clinical research associates, faculty in academic institutions, regulatory affairs specialists, supervisors of clinical microbiology laboratories, research scientists in pharmaceuticals and biotechnology, and quality assurance directors in industry.

In order to receive the Master of Science in Microbiology degree, one must complete a minimum of 40 semester credits, and a Master's thesis presented in a seminar-like setting of peers and faculty. Core courses include microbial physiology and genetics, immunology, management, pathology, epidemiology, and statistics. The student must select a minimum of nine credits in one of three areas of specialization: (1) clinical microbiology, (2) microbiological research/biotechnology or (3) infection control. Electives in areas such as virology, techniques in molecular biology, parasitology, antimicrobial agents, education, financial management, genomics and bioinformatics, presentation skills, clinical trials, pharmacoeconomics, laboratory animal science, and other related sciences are available. In addition, students will undertake clerkship and research training in areas that enhance their career options. Students may pursue advanced graduate or professional degree programs.

Applicants for admission to the program must possess a baccalaureate degree in biology, microbiology, chemistry, or related scientific discipline from an accredited institution, and meet the general admissions requirements of the College of Graduate Studies. Applicants should have completed undergraduate courses in organic chemistry, biochemistry, and an introductory course in microbiology. Students without a strong undergraduate background in microbiology or practice experience will be expected to complete a minimum of four semester hours of graduate course work in clinical microbiology while enrolled in the program, in addition to the normal course of study.

This graduate program may be completed on a part-time basis over a two-to-four year period. Students may continue to hold a full-time position and thus be eligible for tuition reimbursement programs which may be available at their place of employment.

Administration

Inquiries on the program should be directed to Georganne Buescher, Ed.D., Associate Dean, Georganne.Buescher@mail.tju.edu, room M-46, Jefferson Alumni Hall, (215) 503-5799.

Program Requirements

Required Courses		Credits
MI 505	Biochemistry of Microorganisms	3
MI 580	Principles of Epidemiology	2
MI 810,820,830	Laboratory Clerkship	6 total
MI 870,880,890	Research in Microbiology	6 total
MI 521	Introduction to Immunology	2
	or	
IM 505	Fundamentals of Immunology	4
GC 660	Statistical Methods for Data Analysis	2
PA 570	Pathologic Aspects of Disease	3
Select from courses in Management:		6 Minimum
GC 515	Quality Measure/Outcomes Analysis In Health Care	3
GC 525	Information Systems in Organizations	3
GC 600	Management Skills	3
GC 605	Performance Improvement	3
GC 610	Strategic Management	3
GC 620	Fundamentals of Financial Management	3
GC 621	Biotechnology Venture Management	2
GC 622	Cases in Financial Management	3

Recommended Elective Courses (A partial list)

GC 510	Database Design and Management	2
GC 526	Presentation Skills	2
GC 529	Laboratory Animal Sciences	2
GC 535	Introduction to Genomics and Bioinformatics	2
GC 615	Grant Management	2
GC 625	Drug Development Issues	2
GC 630	Fundamentals of Clinical Trials	3
GC 635	Fundamentals of Clinical Trial Management	2
GC 650	Pharmacoeconomics	3
GC 655	Clinical Epidemiology	2
GC 670	Experimental Design in Research	2
GC 680	Laboratory Techniques in Molecular Biology	2
GC 690	Regulatory Issues in Scientific Research	2
GC 720	Scientific Writing	2
MI 520	Diagnostic Parasitology	2
MI 530	Pathogenesis	2
MI 532	Medical Mycology	2
MI 540	Microbiology of Antimicrobial Agents	3
MI 582	Diagnostic Microbiology	4
MI 590 A	Introduction to Clinical Virology	2
MI 590 B	Introduction to Clinical Virology/Laboratory	1
MI 610	Microbiology Teaching Experience	2
MI 613	Retroviruses: Structure, Replication & Pathogenesis	2
MI 614	The Biology & Pathogenesis of AIDS	2
MI 682	Advanced Diagnostic Microbiology	2
MI 718	Infectious Disease Rounds	1
PR 530	Fundamentals of Biosafety	2

Completion of a written and oral presentation of an MS Thesis are required.

Graduate Faculty

Professors

DAVID ABRAHAM, B.S., M.S., Ph.D., University of Pennsylvania, 1983: Parasite immunology. Role of eosinophils in innate and adaptive immunity to nematode parasite infections, vaccine development against *Onchocerca volvulus,* mechanism of immune control of infections and disease caused by *Strongyloides stercoralis;* chemotherapy of leishmaniasis.

CATHERINE E. CALKINS, B.A., Ph.D., Purdue University, 1972: Cellular immunology; immunoregulation of antiself reactivity; autoimmune disease; antiviral immunity; Hepatitis B virus.

DONALD LEE JUNGKIND, B.S., M.S., Ph.D., University of Texas at Galveston, 1972: Sexually transmitted diseases and automation in clinical microbiology.

ROBERT KORNGOLD, B.A., M.S., Ph.D., University of Pennsylvania, 1979: Director of Graduate Program in Immunology: Transplantation, autoimmunity, and T-cell immunobiology; problems related to bone marrow transplantation, including graft-versus-host disease (GVHD), graft failure, and graft-versus-leukemia responses; the T-cell response to minor histocompatibility antigens; development, mechanism, and therapeutic inhibitory effects of structure-base designed peptides.

JUSSI J. SAUKKONEN, M.D., Helsinki University School of Medicine, 1956: Dean of the College of Graduate Studies.

Research Professor

JAMES J. DIAMOND, B.S., M.S., Ph.D., Syracuse University, 1970: Statistics, research methods.

Associate Professor

BRUCE A. FENDERSON, B.S., Ph.D., Johns Hopkins University, 1980: Mechanisms of morphogenesis and malignancy; role of cell surface carbohydrates in developmental processes and differentiation; the glycolipids of human germ cell tumors and the role of hyaluronan in regulating cell migration.

Adjunct Associate Professor

DENNIS M. GROSS, B.A., M.Sc., Ph.D., University of California, Los Angeles, 1974: Scientific strategist and operations expert. Drug discovery process; which elements of chemistry, biology, molecular biology, clinical research and development must be brought together in a cohesive effort in order to bring new drugs from bench to bedside.

Assistant Professor

ALAGARSAMY SRINIVASAN, M.S., M.Ph., Ph.D., Jawaharlal Nehru University, 1977: Retroviruses: structure, replication, and virion morphogenesis; HIV volecular biology; role of HIV genes in AIDS pathogenesis; enetic heterogeneity of HIV.

Clinical Assistant Professor

GEORGANNE K. BUESCHER, B.S., M.S., Ed.D., Temple University, 1984: Diagnostic microbiology; rapid methods of identification, curriculum development.

Adjunct Clinical Assistant Professor

JEROME G. BUESCHER, B.A., Ph.D., Thomas Jefferson University, 1981: Clinical microbiology; rapid methods, cost containment measures; quality assurance; rational test utilization.

Course Descriptions

MI 505* Biochemistry of Microorganisms (Bear, Gorman)

Credits 3
Fall

The course is designed to teach the fundamental concepts of biochemistry as it applies to microorganisms. Students will become acquainted with the biochemical pathways involved in microbial metabolism. They will become familiar with the catabolic and anabolic pathways that are required for metabolism to occur and develop an understanding of the interrelationships between catabolism and anabolism that make microbial physiology possible. This course reflects a restructuring of the course content in MI 502 and MI 503, Biology of Microorganisms I and II and replaces them as a core course for entering students.

MI 520 Diagnostic Parasitology (Buescher, Conti)

Credits 2
Summer

This course familiarizes the students in the M.S. Microbiology program with the medically important parasites. Students will use hypermedia computer assisted learning modules which include high resolution photographic images with overlays of descriptive text, illustrations and detailed textual information. Information on the following areas will be included in the computer learning program: life-cycle stages, geographical distribution, epidemiology and prevention, clinical characteristics, therapy for and pathogenesis of each of the medically important parasites. A variety of graphical menus and maps representing the life cycles of individual parasites are available to interested students. Laboratory sessions will be held so that students will become familiar with the technical procedures used for the identification of parasites and the selection of appropriate specimens for laboratory testing. Supplemental lectures will provide students with information from recent journal articles in the field covering such topics as immunology, antiparasitic drug therapy, and vaccine development.

MI 521* Introduction to Immunology (J. Buescher)

Credits 2
Fall

The course introduces the students to the immune system as an adaptive defense system that recognizes invading pathogenic organisms and mounts a response to eliminate or neutralize foreign infectious agents. The students will be introduced to the molecules, the cells, and organs, and the processes involved in host defense against infection. An overview of basic principles, concepts, and techniques used to assess immune status will be presented.

MI 530 Pathogenesis (Buescher, Pellini)

Credits 2
Fall

Provides students with a framework of understanding of the complex set of interactions between bacteria and the hosts they colonize and infect. After completing this course, the students should be familiar with the myriad of mechanisms, physical and biochemical, that bacteria employ and the effects of these factors on their human hosts. This course should serve as the foundation for understanding the process of infectious diseases.

MI 532 Medical Mycology (Buescher, Gorman)

Credits 2
Spring II

In depth discussions and laboratory study of the medically significant systemic, subcutaneous, cutaneous, superficial, and opportunistic mycoses. Emphasis will be given to a greater understanding of the morphological, physiological, and pathogenic characteristics of fungi.

MI 540 Microbiology of Antimicrobial Agents (Buescher)

Credits 3
Prerequisite: MI 505 or permission of instructor
Summer

The purpose of the course is to provide students with information on the action of antibiotics and chemotherapeutic agents at the molecular level. Students will be introduced to the strategies developed by cells to counteract the action of the antimicrobial agents. Through the use of lectures and demonstrations, students will be able to describe the basic methods for *in vitro* testing of antimicrobial agents.

MI 580* Principles of Epidemiology (G. Buescher, Robbins)

Credits 2
Spring II

This course will present the science of epidemiology using examples from the whole field of pubic health. Beginning with the basic concepts the course will include examples of the broad range of modern applications of epidemiology. Students will become familiar with the role of epidemiology as applied in environmental/occupational medicine, pharmaceuticals, health outcomes research, infectious diseases and cancer care.

MI 582 Diagnostic Microbiology (J. Buescher)

Credits 4
Fall

The purpose of the course is to introduce students to the fundamental elements underlying all subsequent learning in microbiology. These elements will be taught within the setting of medical microbiology. Learning microbiology within that format will give students the additional benefit of becoming familiar with the terms and constructs of clinical medicine.

MI 590A Introduction to Clinical Virology(A) (J. Buescher)

Credits 2
Spring I

Basic virology including structure of viruses and treatment and prevention of viral disease. MI 590A is the virology portion of MI 500.

MI 590B Introduction to Clinical Virology(B) (Jungkind)

Credits 1
Spring II

Techniques used in clinical laboratories to isolate and identify viruses. Lecture and laboratory.

MI 610 Microbiology Teaching Experience (G. Buescher)

Credits 2
Fall

Supervised practice in teaching laboratory skills and data interpretation in a microbiology teaching laboratory. During the fall semester, students will spend four hours per week engaged in the laboratory classroom instruction of students enrolled in MI 500 and may be required to prepare and present a didactic lecture at a prelaboratory conference. Students will be assessed on their ability to present information in the laboratory setting, knowledge of the subject, critique of student assignments, bench-level teaching skills, use of audiovisual and other teaching materials, and didactic presentation.

MI 613 Retroviruses: Structure, Replication and Pathogenesis (Srinivasan)

Credits 2
Fall

This course provides information about retroviruses at the biological and molecular level. Retroviruses have been extensively used as a model system to understand the processes involved in the development of leukemia/lymphoma. The discovery of retroviruses associated with human diseases and the possibility of using retroviruses as gene therapy vectors further stimulated research on retroviruses in the last 15 years. A major thrust of this course is to stimulate thinking about retroviruses from an experimental, therapeutic, and diagnostic point of view.

MI 614 The Biology and Pathogenesis of AIDS (Srinivasan)

Credits 2
Prerequisite: MI 613 or permission of instructor
Spring II

HIV-1 is the most studied retrovirus in human history. This course will survey the molecular and cellular biology of HIV-1, the epidemiology and disease processes associated with infection, and the pathogenic mechanisms believed to mediate the various diseases associated with AIDS. The course will also consider current animal models as well as current and potential therapies such as antisense oligonucleotides and gene therapy.

MI 682 Advanced Diagnostic Microbiology (J. Buescher)

Credits 2
Spring II

A seminar course dealing with contemporary issues in Clinical Microbiology. Such issues include the biology and nature of emerging agents of infectious disease, pathogenesis and disease spectrum of disease produced by such agents, epidemiology of disease produced by such agents, laboratory diagnosis of the agents, and therapeutic considerations. Additional issues include the need to maintain compliance with regulatory requirements and to achieve cost-effectiveness in the era of managed care and cost containment. A final issue is the ability of the microbiologist to present, in a clear and understandable fashion, such issues discussed above to fellow scientists, laboratory administrators, and laboratory clients.

MI 718 Infectious Disease Rounds (Jungkind, et al.)

Credits 1
Prerequisite: Clinical laboratory experience or permission of course coordinator
Fall

For students specializing in clinical microbiology only. Clinical conference dealing with laboratory results in selected clinical cases, relating these results to the clinical and epidemiological features of the disease.

MI 810, 820, 830* Laboratory Clerkship (G. Buescher)

Credits variable 1-6

By arrangement and faculty approval, students in the Master of Science in Microbiology Program will spend a period of time in laboratories in a field of special interest to the student.

MI 870, 880, 890* Research in Microbiology (G. Buescher)

Credits 6

Each master's student undertakes laboratory investigation of his/her own choosing, dealing with a question in microbiology such as evaluation or development of a new technique for isolation or identification of microorganisms or participation in an ongoing research project. A written thesis and an oral presentation on the work is required at its conclusion.

GC 510 Database Design and Management (Waldman, Leone)

Credits 2
Summer

This applied, "how to" course lays the groundwork for an object-oriented approach to relational database development. The approach focuses on identification, formalization, and verification of study data. Students will learn how to collect and organize information into well-developed objects and relationships. Students will have the opportunity to perform statistical analyses on several real data sets using general-purpose statistical software packages. The course will also introduce students to Epi Info®, a public domain epidemiologic database and analysis application.

GC 515 Quality Measure/Outcomes Analysis in Health Care (Nash, Goldfarb)

Credits 3
Fall

The course will cover methods for quality measurement and improvement, application of these methods in various settings and populations, and current and future directions in quality. Student will develop an understanding of issues in defining and measuring quality of care in a variety of health care settings, and learn the skills to measure quality and analyze outcomes.

GC 525 Information Management (Bross)

Credits 3
Maximum number of students 15
Fall, Spring II

This course is designed to provide a detailed understanding of information systems and their use within the modern organization. It will explore the essential components of the systems and analyze how each is developed and linked into a production system. Contemporary computing concepts will be examined and a profile of strategic information management issues will be presented. Particular emphasis will be placed on the role of technology in assisting organizations to meet their operational and strategic goals. The course incorporates Internet activities, spreadsheets, and a database management package.

GC 526 Presentation Skills (Buescher, Scott)

Credits 2
Maximum number of students 16
Spring I

This course focuses on skills needed to make successful oral presentations, and poster presentations. Although no specific prerequisite courses are required, the nature of this course demands that students be at a point in their careers where they are prepared to make both an oral and poster presentation on a topic germane to their interests.

GC 529 Laboratory Animal Sciences (Jepsen)

Credits 2
Spring II

This course will introduce students to laboratory animal science. Topics will concern regulations and their effect on the care and use of laboratory animals, the biology, husbandry, and diseases of common laboratory animal species, ethical and scientific issues, experimental surgery and animal research techniques.

GC 535 Introduction to Genomics and Bioinformatics (Williams, Pellini)

Credits 2
Spring I

This course introduces the principles of medical genetics to graduate students who require a working knowledge of modern molecular genetics. The first half of the course will provide students with a background for understanding the genetics of disease. Topics to be reviewed will include: the chromosomal basis of heredity; the structure and function of genes and chromosomes; and the patterns of single and multifactorial inheritance. The second half of the course will acquaint students with the newly emerging fields of study as a result of sequencing projects (Bioinformatics, Proteomics and Pharmacogenomics) and explore the potential career opportunities in these areas. Several presentations will also be devoted to accessing DNA and protein analysis programs through the Internet, so that the student can gain hands-on experience navigating web-based information tools and extracting information from the growing number of databases available to biomedical researchers.

GC 600 Management Skills (G. Buescher, Arsenault)

Credits 3
Maximum number of students 25
Fall

This course introduces current theories and concepts of leadership and management and develops the skills necessary to successfully perform as a manager and leader. Based on input from focus groups with representatives from the pharmaceutical, biotechnology and healthcare industries, the course gives special emphasis to developing skills for collaboration, improved communication, problem solving, managing change, and reengineering.

GC 605 Performance Improvement (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Fall

This course provides an introduction to the principles and concepts of Performance Improvement, (similar to the concepts of Total Quality Management, TQM). Emphasis will be on the importance of employee involvement and critical nature of customer focus. Material will demonstrate why performance improvement is so important in any industry and how these principles and concepts can be applied. It will provide an orientation to the analytical tools used in performance improvement projects, and apply them to real work situations. Students will differentiate between the role of the project team and the role of line management. Class will discuss national quality awards and benchmarks.

GC 610 Strategic Management (Buescher, d'Arville)

Credits 3
Spring II

This course introduces the student to the Strategic Management Process as a base, to build on the basic management skills that the student has developed to date. The student will learn the nature and importance of planning; develop a "plan" for planning; relate planning to change management; and outline, investigate, and use the strategic management process. The student will learn to perform a situational audit, formulate program strategies and long and medium-range objectives, and learn the steps in strategic implementation.

GC 615 Grant Management (Grunwald)

Credits 2
Summer

This course is designed to serve as an introductory overview of the pre- and post-application procedures that relate to the writing, submission, review, award, and management of research grants. The areas included will be covered from both the perspective of the principal investigator as well as from the administrative viewpoint.

GC 620 Fundamentals of Financial Management (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Spring I

The purpose of this course is to introduce the non-financial manager to financial systems, principles of accounting and their relationship to basic business activities. These concepts will be relevant to the research laboratory and discussion will center on basic financial statements and their analysis, financial planning, business language, and concepts, preparation and interpretation of financial statements. The use of electronic worksheets will also be incorporated in the analysis of case studies.

GC 621 Biotechnology and Venture Management (Saukkonen, Chou)

Credits 2
Summer

Students will be taught how to identify and analyze the factors that contribute to the creation of successful new business ventures. They will learn to consider the management problems associated with the founding of a new enterprise, either as a small business or as a part of an existing corporation. They will discuss the concepts and use the methodologies for putting together a successful business plan. Emphasis in the course will be on technology-based innovation.

GC 622 Cases in Financial Management (Buescher, Chatterton)

Credits 2
Prerequisite: GC 620 or permission of instructor
Maximum number of students 8
Fall

The course is designed to provide a Case Study approach for the implementation skills learned in GC 620. Students will work as Department Managers in a health care or academic "case" organization reviewing monthly financials, recommending actions based on their review, and preparing an annual budget. Students will complete a formal budget presentation and "defense" and attend mock meetings of Department heads with the instructor acting as CEO or CFO of the organization.

GC 625 Drug Development Issues (Gross)

Credits 2
Summer

This course explores the drug development process primarily at steps post-basic research. The course will examine the domestic and international regulatory environment, current requirements, and new drivers in the development process, specifically outcomes research and pharmacoeconomics.

GC 630 Fundamentals of Clinical Trials (Hauck)

Credits 3
Minimum number of students 12
Maximum number of students 20
Fall

This course introduces students to the fundamentals of clinical trials, from choosing a question and writing a protocol, through running a trial, to analyzing and reporting results. Key topics include how to assure validity in trials, what to include in a protocol, quality assurance of ongoing trials, statistical methods for analyzing trials, and how to review critically the reports of trials.

GC 635 Fundamentals of Clinical Trial Management (Saukkonen, Lata)

Credits 2
Spring I

This course introduces key principles and practical applications for the development of new pharmaceutical compounds. It will 1) introduce the student to the total clinical research process from the perspective of the current Good Laboratory Practices (GLP) and the current Good Clinical Practices (GCP), including specific global regulatory guidelines frame-working the development and approval of new pharmaceuticals; 2) focus on the responsibilities and effective interactions between the investigating research site and the various regulatory entities charged with ensuring the protection of the human research subject as well as the overall integrity of the clinical trial and the sponsor; 3) ensure that the student will be able to relate "real world" experiences and techniques to regulatory requirements, necessary to effectively prepare for and conduct a variety of clinical trials from the perspective of the investigator and sponsor.

GC 650 Pharmacoeconomics (Nash, Lofland)

Credits 3
Spring I

This course provides a thorough introduction to the field of pharmacoeconomics and disease management. Beginning with the basics such as reasons for study, the challenges facing experts, and the significance of the science, the course will propel students through the practical knowledge necessary to embark on current, valid, comprehensive studies. Cost benefit, cost utility, cost effectiveness methods will be defined in detail. Accounting and finance will be integrated with statistics and database skills. Students will learn how to use available technology to their advantage and will gain hands-on experience by conducting case studies of their own. In addition, the course includes a general introduction to managed care, including all relevant terminology, government institutions, current public policy, and varying viewpoints of experts in the field.

GC 655 Clinical Epidemiology (Waldman, Weinberg)

Credits 2
Prerequisite: MI 580 or permission of Instructor
Fall

The goal of this course is to introduce how basic epidemiologic and biostatistical techniques, useful in describing the determinants of disease in a population, can be used to answer specific clinical questions. Topics to be considered include issues of study design, cost-effectiveness and critical appraisal of the literature.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

GC 670 Experimental Design in Research (Diamond)

Credits 2
Prerequisite: GC 660 or permission of instructor
Spring II

The purpose of this course is to have students apply the principles and techniques of basic statistical analysis specifically to development of clinical research protocols. Lecture and workshop sessions will be used to gain an in-depth understanding of the issues relating to experimental design and conduct.

GC 680 Laboratory Techniques in Molecular Biology (Buescher, Kuo)

Credits 2
Maximum number of students 16
Fall, Spring II

The purpose of the course is to introduce the students to basic techniques in molecular biology, including genetic engineering. Beginning with an introduction to the biological significance of DNA and the fundamentals of good laboratory practices, students will become familiar with: purification and characterization of nucleic acids; cloning vectors, enzymes used in DNA cloning, and *E. coli* host strains; principles of restriction mapping, recombinant library construction, and the polymerase chain reaction; production and use of nucleic acid probes in hybridization to filter-immobilized DNA. Students will be instructed in the biochemical and biological concepts involved in the selected molecular biology techniques so that, at the completion of the course, students will have the ability to work through technical problems in this "kit-oriented" era, and to assimilate new techniques as they arise.

GC 690 Regulatory Issues in Scientific Research (Smith)

Credits 2
Spring II

The course is designed to familiarize students with regulations governing scientific research, specifically research involving human subjects. Lectures and discussions will focus on the history of regulations governing human subject research, regulations protecting human research subjects, regulations concerning the development of new drugs and devices, and regulations dealing with the use of ionizing radiation, isotopes, recombinant DNA, and gene therapy.

GC 720 Scientific Writing (Buescher, Dohm)

Credits 2
Summer

This course concentrates on the process of writing the dissertation / thesis or research paper and on the effective presentation of scientific information. Students will learn to write the sections of a research paper or thesis and will develop skills with various pieces of productivity software such as word processors, spreadsheets and statistical packages. Students will learn how to create sophisticated documents to improve communication of scientific information. The course emphasizes a reader-oriented approach to writing, critical analysis of good biomedical writing, and strong presentation of data and ideas. Some time will also be spent on principles of effective oral presentations.

IM 505 Fundamentals of Immunology (Korngold, et al.)

Credits 4
Permission of instructor required
Fall

A comprehensive course encompassing the major areas of Immunology: 1) the cells and organs of the immune system; 2) nature of antigens, antibodies, and receptors; 3) lymphocyte activation, proliferation, and differentiation; 4) the major histocompatibility complex; 5) regulation of the immune response; 6) effector mechanisms of immunity; and 7) immunologic mechanisms in disease. The format will involve both lecture and discussion of specific topics, and students will be encouraged to acquire an understanding of classical and modern immunological concepts through analysis of their experimental bases. Discussion of critical techniques in Immunology will be incorporated throughout the course. Assigned reading.

PA 570 Pathologic Aspects of Disease (Fenderson)

Credits 3
Summer

The course will cover topics in general and systemic pathology, providing an overview of major aspects of human pathology and the pathophysiology of major diseases. Lectures supplemented with computer module containing case studies, clinical correlations and self-assessment components.

PR 530 Fundamentals of Biosafety (Grunwald, Souder)

Credits 2
Spring I

This purpose of this course is to provide students with a basic knowledge of biosafety as related to good laboratory practice. The course will begin with an introduction to Federal biosafety regulations, guidelines and standards, the role of the Biological Safety Officer in the institution and the epidemiology of laboratory-associated infections. Students will become familiar with: concepts in biotechnology and cell biology; means of exposure to biohazardous agents; hazard assessment in the laboratory; laboratory design criteria when using biohazardous agents; good laboratory practice, (GLP); decontamination, sterilization, disinfection and proper disposal of infectious waste; packaging and shipping of biohazardous material; biosafety training design and implementation; and special considerations related to gene therapy.

*Required core courses.

Master of Science Program in Nursing

The purposes of the Graduate Division of the Department of Nursing are to:

1. Prepare advanced practice practitioners who anticipate and respond to changing societal, health care and professional needs;
2. Develop practitioners who use advanced skills and knowledge in implementing their professional role; and
3. Foster continuing development of nursing science, professional foundations, and nursing roles.

The Master of Science Program in Nursing is designed to prepare nurses for advanced and sophisticated clinical practice in roles as clinical nurse specialist, case manager, nurse practitioner and nurse administrator.

The Department of Nursing offers nurse practitioner, clinical nurse specialist, and post master's certificate programs in Acute Care, Adult Health, Community Systems Administration, Oncology, Pediatrics, and a Family Nurse Practitioner option. In addition, a Family Nurse Practitioner/Community Systems Administration integrated program is available.

Graduate Program Objectives

At the completion of the program, the graduate will:

1. Synthesize concepts and theories from nursing and related disciplines to form the basis for advanced nursing practice;
2. Demonstrate proficiency in the management and use of advanced technology related to client care and support systems;
3. Demonstrate expertise in a defined area of advanced practice;
4. Utilize research finding to provide high quality health care, initiate change and improve nursing practice;
5. Analyze political, economic, ethical and socio-cultural dimensions that influence client care and outcomes;
6. Utilize leadership and management strategies for advanced nursing practice;
7. Engage in intra- and inter-disciplinary collegial relationships in the conduct of advanced nursing practice.

Admission Requirements

1. Bachelor of Science in Nursing (B.S.N.) or Nurse Doctorate (N.D.) from a National League for Nursing (N.L.N.) accredited school or registered nurse graduate of a N.L.N. accredited associate degree or diploma program;
2. A minimum G.P.A. of 3.00 (on a 4.00 scale) earned at the baccalaureate level;
3. Competitive performance on the Graduate Record Examination or the Miller Analogies Test;
4. Professional registered nurse licensure;

5. A minimum of one year of clinical experience as a registered nurse in order to matriculate into the program. Experience in a clinical setting congruent with selected area of specialization is recommended;
6. Introductory courses in Elementary Statistics and Nursing Research;
7. Computer literacy;
8. A course in basic physical assessment skills. If integrated in undergraduate course of study, evidence must be submitted for evaluation;
9. Three references: two (2) professional and one (1) academic;
10. A personal interview, when requested;
11. An English proficiency examination may be required of applicants whose native language is not English;
12. Cardiopulmonary resuscitation (C.P.R.) certification;
13. An essay addressing professional goals;
14. A resume.

Program Specialty Areas

All students enrolled in the Master of Science Program in Nursing at Thomas Jefferson University share a **core curriculum**. Courses required in the core curriculum are:

Required Courses		Credits
NU 602	Health Policy, Ethical and Legal Dimensions of Care	3
NU 603	Research Design	3
NU 604	Research Seminar	3
NU 605	Role of the Advanced Practice Nurse	3
NU 625	Epidemiology for Advanced Nursing Practice	3
NU 672	Informatics for Advanced Nursing Practice	3

Acute Care Advanced Practice Nurse

The purpose of the Acute Care Advanced Practice Nurse track is to prepare graduates to assess and manage the full continuum of acute care services required by patients who are acutely and critically ill. The core knowledge provided in the curriculum is based on the full spectrum of high acuity patient care needs. Upon completion of the Acute Care Advanced Practice Nurse track, students are eligible for Acute Care Nurse Practitioner and/or Clinical Nurse Specialist Certification.

In addition to the core curriculum, the following courses are required for students enrolled in the Acute Care Advanced Practice Nurse specialty area:

Courses		Credits
ID 560	Advanced Pharmacotherapeutics	3
NU 673	Comprehensive Assessment for Clinical Decision Making	3
PA 570	Pathologic Aspects of Disease	3
OR		
NU 570	Pathophysiology of Human Disease	3

NU 631	Diagnostic Reasoning and Clinical Decision Making for Acute Care Advanced Practice Nurse I	3
NU 632	Diagnostic Reasoning and Clinical Decision Making for Acute Care Advanced Practice Nurse II	3
NU 633	Diagnostic Reasoning and Clinical Decision Making for Acute Care Advanced Practice Nurse III	3
NU 674	Management of Common Health Problems in Primary Care	3
NU 630	Diagnostic Reasoning and Clinical Decision Making for Adult Advanced Practice Nurse II	3
NU 676	Management of Adults and Older Adults	3

Adult Advanced Practice Nurse

The Adult Advanced Practice Nurse track is designed to prepare advanced practice nurses as clinical nurse specialists and adult nurse practitioners. In-depth knowledge enables the advanced practice nurse to manage the care of patients in a variety of health care settings. Specialization provides the opportunity to deliver continuity of care through assessment, teaching, case management, and evaluation. Upon completion of the Adult Advanced Practice Nurse track, students are eligible for Adult Nurse Practitioner Certification and/or Clinical Nurse Specialist through the American Nurses' Association.

In addition to the core curriculum, the following courses are required for students enrolled in the Adult Advanced Practice Nurse specialty area:

Courses		**Credits**
ID 560	Advanced Pharmacotherapeutics	3
NU 673	Comprehensive Assessment for Clinical Decision Making	3
PA 570	Pathologic Aspects of Disease	3
OR		
NU 570	Pathophysiology of Human Disease	3
NU 674	Management of Common Health Problems in Primary Care	3
NU 630	Diagnostic Reasoning and Clinical Decision Making for Adult Advanced Practice Nurse II	3
NU 676	Management of Adults and Older Adults	3

Oncology Advanced Practice Nurse

The Oncology Advanced Practice Nurse track is designed to prepare advanced practice oncology nurses to design, assess, and manage the care of patients with cancer and their families across the continuum of illness. In addition to the graduate core and support courses, students take Management of Common Health Problems in Primary Care prior to the two oncology courses. Graduates are eligible for Adult Nurse Practitioner Certification and/or Oncology Nurse Certification.

In addition to the core curriculum, the following courses are required for students enrolled in the Oncology Advanced Practice Nurse specialty area:

Courses		Credits
ID 560	Advanced Pharmacotherapeutics	3
NU 673	Comprehensive Assessment for Clinical Decision Making	3
PA 570	Pathologic Aspects of Disease	3
OR		
NU 570	Pathophysiology of Human Disease	3
NU 674	Management of Common Health Problems in Primary Care	3
NU 634	Diagnostic Reasoning and Clinical Decision Making for Oncology Advanced Practice Nurse II	3
NU 635	Diagnostic Reasoning and Clinical Decision Making for Oncology Advanced Practice Nurse III	3

Pediatric Advanced Practice Nurse

The purpose of the Pediatric Advanced Practice Nurse track is to prepare graduates in the care of children and their families. Pediatric advanced practice nurses in clinical practice, school-based health, home health, public health, acute and long-term care settings have been extremely effective in providing health care to a large segment of the pediatric population. The track prepares students to manage the direct care of infants and children, and incorporates the various roles associated with advanced nursing practice in a variety of care settings. Upon completion of the Pediatric Advanced Practice Nurse track, students are eligible for Pediatric Nurse Practitioner and/or Clinical Nurse Specialist Certification.

In addition to the core curriculum, the following courses are required for students enrolled in the Pediatric Advanced Practice Nurse specialty area:

Courses		Credits
ID 560	Advanced Pharmacotherapeutics	3
NU 673	Comprehensive Assessment for Clinical Decision Making	3
PA 570	Pathologic Aspects of Disease	3
OR		
NU 570	Pathophysiology of Human Disease	3
NU 640	Diagnostic Reasoning and Clinical Decision Making for Pediatric Advanced Practice Nurse I	3
NU 641	Diagnostic Reasoning and Clinical Decision Making for Pediatric Advanced Practice Nurse II	3
NU 642	Diagnostic Reasoning and Clinical Decision Making for Pediatric Advanced Practice Nurse III	3

Family Nurse Practitioner

The Family Nurse Practitioner specialty prepares students to deliver comprehensive primary care to individuals from infancy throughout adulthood. The Family Nurse Practitioner curriculum emphasizes collaboration and interdisciplinary strategies for meeting primary care needs of consumers. A strong emphasis is placed on the acquisition of knowledge and skills necessary for a family-centered approach to health promotion and illness intervention. Clinical experiences are available in a wide variety of ambulatory setting with nurse practitioners and physicians serving as preceptors. In addition to the core curriculum, the following courses are required for students enrolled in the Family Nurse Practitioner specialty:

Family Nurse Practitioner Required Courses		Credits
NU 673	Comprehensive Assessment for Clinical Decision Making	3
ID 560	Advanced Pharmacotherapeutics	3
PA 570	Pathologic Aspects of Disease	3
OR		
NU 570	Pathophysiology of Human Disease	3
NU 674	Management of Common Health Problems in Primary Care	3
NU 675	Management of Women and Children	3
NU 676	Management of Adults and Older Adults	3

Post-Master Nurse Practitioner Certification

A post-Master certification program is available for professional nurses who have earned an M.S.N. degree and wish to continue their education and expand their practice as a nurse practitioner. The certificate post master's option is available in the acute care, adult, family, oncology, and pediatric nurse practitioner programs. The total credits required for the post-Master certification option is twenty-one (21). Requirements for admission to the program are:

1. Completion of the M.S.N. application;
2. Transcript from previously completed M.S.N. program;
3. A minimum GPA of 3.5 (on a 4.0 scale) earned in the M.S.N. program;
4. An essay stating professional goals;
5. Resume/*curriculum vitae;*
6. A personal interview when requested.

Post-Master's Nurse Practitioner Required Courses		Credits
NU 625	Epidemiology for Advanced Nursing Practice	3
NU 673	Comprehensive Assessment for Clinical Decision Making	3
ID 560	Advanced Pharmacotherapeutics	3
PA 570	Pathologic Aspects of Disease	3
OR		
NU 570	Pathophysiology of Human Disease	3
NU*	Clinical Course I	3
NU*	Clinical Course II	
NU*	Clinical Course III	3

*Course number and title depends on specialty area.

Community Systems Administration

The Community Systems Administration specialty is designed to address the evolving health care system and market place that emphasizes prevention and primary care. The evolving system has generated a demand for visionary leaders in a variety of new and emerging health care organizations. This specialty prepares students for advanced practice nursing and health care administration roles. The curriculum focuses on the development of skills necessary to plan, design, manage, and evaluate health care programs in a variety of settings. In addition to the core curriculum, the following courses are required for students enrolled in the Community Systems Administration specialty:

Community Systems Administration Required Courses		Credits
GC 610	Management: Planning for Change	3
ID 570	Financial Management of Healthcare Organizations	3
- - - - - -	Elective	3
NU 681	Community Systems Administration I	3
NU 682	Community Systems Administration II	3
NU 683	Community Systems Administration III	3

Community Systems Administration and Family Nurse Practitioner

The combined Community Systems Administration and Family Nurse Practitioner track curriculum is designed to integrate the knowledge and expertise needed to plan, implement, and evaluate care for individuals, as well as families, aggregates, and communities. With the health care movement from hospital-based to community-based settings, nursing leadership is needed to direct and deliver care to individuals within the context of their community. In addition to care management, the combined Community Systems Administration and Family Nurse Practitioner track emphasizes development of the knowledge and expertise to assess the health status and health care systems of communities and to design, implement, and evaluate needed nursing, health, and management interventions. Graduates of the combined Community Systems Administration and Family Nurse Practitioner track have expanded career opportunities in the community-oriented health care system where expertise in management of patients, administration, and planning and evaluating health programs for groups or communities is required. The track requires 48 credits.

In addition to the core curriculum, the following courses are required for students enrolled in the Community Systems Administration and Family Nurse Practitioner specialty area:

Courses		Credits
ID 560	Advanced Pharmacotherapeutics	3
NU 673	Comprehensive Assessment for Clinical Decision Making	3
PA 570	Pathologic Aspects of Disease	3
OR		
NU 570	Pathophysiology of Human Disease	3
ID 570	Financial Management of Health Care Organizations	3
NU 681	Community Systems Administration I	3
NU 682	Community Systems Administration II	3
NU 683	Community Systems Administration III	3
NU 674	Management of Common Health Problems in Primary Care	3
NU 675	Management of Women and Children	3
NU 676	Management of Adults and Older Adults	3

Other Nursing Program Options

The following programs have slightly different curriculum and slightly different admission requirements. The specifics on these programs may be obtained by contacting:

The Office of Admissions and Enrollment Management
College of Health Professions
Thomas Jefferson University
130 South Ninth Street, Suite 1610
Philadelphia, PA 19107-5233
(215) 503-8890

RN – BSN/MSN Option

The RN-MSN option is designed for Registered Nurse (RN) students who have obtained their basic nursing education at either a Diploma or Associate Degree Program. The RN-BSN/MSN option enables RN students to qualify for admission to graduate nursing education at Thomas Jefferson University through a combined BSN/MSN program. The goal of the RN-BSN/MSN option is to provide a mechanism for RN students to earn the BSN and MSN degrees in a seamless integrated curriculum. At the conclusion of the program, the BSN and MSN degrees are awarded.

The Accelerated Pathway to the M.S.N.

The Accelerated Pathway is an option designed for students who already hold a bachelor's degree in a field other than nursing. This special program builds on the baccalaureate degree and allows students to complete a B.S.N. and an M.S.N. in a shortened time frame. Generic and R.N.-B.S.N. students who have a non-nurse baccalaureate degree may apply for admission to the Accelerated Pathway to the M.S.N. Students accepted into the Pathway are admitted to both undergraduate and graduate programs. Upon satisfactory completion of the lower division requirements, the student is admitted to the nursing major. Generic students are enrolled in the undergraduate program for their first two years. R.N.-B.S.N. students are enrolled in the undergraduate program for the first year. Following successful completion of the state nursing licensing exam and faculty evaluation, generic students then progress to the graduate program to complete the required coursework. R.N.-B.S.N. students progress directly to the graduate program if they have had prior R.N. work experience. It is at this time that students must select the specialty area in the M.S.N. program they wish to pursue.

All policies in regard to academic achievement, progression in the Nursing major, and program completion for the generic and R.N.-B.S.N. student apply to the student in the Accelerated Pathway to the M.S.N.

An admission interview with the nurse counselor is recommended and will be scheduled through the Office of Admissions and Enrollment Management.

Graduate Faculty

Professor

ANNE E. BELCHER, Ph.D., R.N., A.O.C.N., F.A.A.N., Florida State University, 1975: Director of the Undergraduate Programs, Oncology; spirituality, psychosocial issues.

Associate Professors

SUZANNE R. LANGNER, CRNP, Ph.D., FAAN, University of Illinois, 1987: Qualitative assessment, family care-giving to the elderly, HIV/AIDS - Early Intervention, improvement of primary care services, outcomes.

MOLLY A. ROSE, F.N.P., R.N., Ph.D., Temple University, 1990: Women and HIV/AIDS; AIDS and the elderly; caregivers of children with HIV/AIDS; health promotion; disease prevention; community health.

MARY G. SCHAAL, R.N., Ed.D., Rutgers University, 1989: Acting Chair of Department of Nursing; Vice-Chair and Director of the Graduate Program in Nursing; Community Health; curriculum design and development; distance education; public/community health.

Assistant Professors

MARY M. BOWEN, C.R.N.P., J.D., D.N.S., University of San Diego, 1996: Adult/Family Health; ethics, critical care, complimentary medicine.

JOSEPH DeRANIERI, Ph.D., R.N., C.N.P., LaSalle University, 1997: Nutritional counseling; crisis intervention, pediatric oncology, international nursing, complimentary medicine.

Course Descriptions

NU 570 Pathophysiology of Human Disease (Fenderson)

Credits 3

This course will cover topics in general and systemic pathology, providing an overview of major aspects of human pathology and the pathophysiology of major diseases.

NU 602 Health Policy, Ethical and Legal Dimensions of Care (Bowen)

Credits 3

This course is designed to advance nursing, occupational therapy and physical therapy practices by synthesizing knowledge about health care as an established social institution. Emphasis will be on an examination of the health care delivery system and issues and trends associated with health care and the implications of these will be explored.

NU 603* Research Design (Langner)

Credits 3
(Cross listed with OT 603 and PT 603)

Emphasis is placed on the acquisition of methods and techniques for extending the scientific base of knowledge for advanced nursing practice. Research studies which address questions of impact on nursing, occupational and physical therapy and which are drawn from an interdisciplinary health perspective, serve as the focus for discussion. Research designs and related statistical processes are examined in terms of their appropriateness for addressing various nursing problems.

NU 604* Research Seminar (Bowen, Rose, Langner)

Credits 3

In this course, the student learns the steps involved in implementation of the research proposal. Existing data sets are analyzed to answer research questions using computer statistical software programs. Modes of disseminating research findings are discussed.

NU 605* Role of the Advanced Practice Nurse (Bowen)

Credits 3

This course explores the role and practice of the advanced practice nurse as expert clinician, educator, consultant, researcher and administrator. The historical, social, political, philosophical and economic forces that have influenced the roles and practice of advanced practice nursing are examined. This is a search and discussion experience aimed at enabling graduate students to become knowledgeable about the role of the advanced practice nurse as a member of the healthcare team.

NU 625* Epidemiology for Advanced Nursing Practice (Rose)

Credits 3

This course applies the concepts, principles, and uses of epidemiology in advanced practice nursing. Population-based collection and analysis of health data and its relationship to health services will be emphasized. Application of epidemiological methods to infectious and chronic diseases will be critically analyzed.

NU 630 Diagnostic Reasoning and Clinical Decision Making for Adult Advanced Practice Nurse II (Bowen)

Credits 3
Prerequisite: NU 674

This course focuses on the comprehensive management of acute and chronic complex health problems experienced by adults. Principles for health promotion, health maintenance, and disease prevention are incorporated into the therapeutic regime. The gynecological care of women is addressed. Emphasis will be

placed on complex illnesses and multisystem illness of the cardiovascular, pulmonary, neurological, renal, gastrointestinal systems, infectious disorders, and nutritional disorders. Concepts of cost effectiveness and efficiency, quality and care management are incorporated into the plan of care. Sixteen hours of clinical practicum per week is required.

NU 631 Diagnostic Reasoning and Clinical Decision Making for Acute Care Advanced Practice Nurse I (Bowen)

Credits 3
Pre- or Corequisites: PA 570 or NU 570, NU 673, and ID 560

This is the first of three 3-credit courses, designed for acute care advanced practice nurse students. The course is designed to introduce acute care advanced practice nurse students to the care of patients who experience surgical intervention. Course content focuses on the integration of core and support course content into the assessment, diagnosis and management of health and illness conditions seen in adult patients in the hospital setting. Clinical practicum is required concurrently.

NU 632 Diagnostic Reasoning and Clinical Decision Making for Acute Care Advanced Practice Nurse II (Bowen)

Credits 3
Prerequisite: NU 631

This is the second of three 3-credit courses, designed for acute care advanced practice nurse students. The course is designed to introduce students to the role of the acute care advanced practice nurse in managing the health care of chronically ill patients who are hospitalized. Course content focuses on the integration of core and support course content into the assessment, diagnosis and management of chronic health problems in adult patients through a conceptual approach. Clinical practicum is required concurrently.

NU 633 Diagnostic Reasoning and Clinical Decision Making for Acute Care Advanced Practice Nurse III (Bowen)

Credits 3
Prerequisites: NU 631 and NU 632

This is the third of three 3-credit courses, designed for acute care advanced practice nurse students. The course is designed to introduce acute advanced practice nurse students to the management of patients who are experiencing critical illness or injury. Course content focuses on the integration of core and support course content into the assessment, diagnosis and management of patients with life threatening illnesses. Clinical practicum is required concurrently.

NU 634 Diagnostic Reasoning and Clinical Decision Making for Oncology Advanced Practice Nurse I (Belcher, Griffiths)

Credits 3
Prerequisite: NU 674

This is the second of three 3-credit courses designed for oncology advanced practice nursing students. The course presents foundational content essential to the management and care of oncology patients. The advanced practice nurses' role in assessing, diagnosing, and monitoring human responses to cancer treatment are developed. Learning related to health assessment and diagnostic reasoning as applicable to the care of individuals experiencing or at risk for cancer is expanded and integrated. Sixteen hours per week of clinical practicum with a preceptor is required.

NU 635 Diagnostic Reasoning and Clinical Decision Making for Oncology Advanced Practice Nurse II (Belcher, Griffiths)

Credits 3
Prerequisite: NU 634

This is the third of three 3-credit courses designed for oncology advanced practice nursing students. Using a systems approach, the course continues the application of underlying principles to the management of patients with malignancies of the gastrointestinal, genitourinary, neurological, gynecologic, endocrine, integumentary, musculoskeletal and hematologic systems, as well as cancers of the head and neck. Knowledge base of the cancer continuum is expanded focusing on primary prevention, prevention and treatment of oncologic emergencies, co-morbidities, rehabilitation, and end of life care. Sixteen hours per week of clinical practicum is required.

NU 640 Diagnostic Reasoning and Clinical Decision Making for Pediatric Advanced Practice Nurse I (Schaal, Gentieu)

Credits 3
Pre- or Corequisites: PA or NU 570, ID 560, NU 673

This course provides an introduction for the pediatric advanced practice nurse student to the conceptual basis for meeting the health promotion and maintenance needs of diverse pediatric populations. This course will prepare the student to assume the role of a care provider, and to contribute and support the collaborative responsibility of other health care members in meeting the health needs of children from birth through adolescence. Sixteen hours per week of clinical practicum with a receptor is required.

NU 641 Diagnostic Reasoning and Clinical Decision Making for Pediatric Advanced Practice Nurse II (Schaal, Gentieu)

Credits 3
Prerequisite: NU 640

This course provides an introduction for the pediatric advanced practice nurse student to the conceptual basis of caring for pediatric populations with acute health problems. It will prepare the student to assume the role of a care provider, and to contribute and support the collaborative responsibility of other health care members, in meeting the acute care needs of children from birth through adolescence. Sixteen hours per week of clinical practicum with a preceptor is required.

NU 642 Diagnostic Reasoning and Clinical Decision Making for Pediatric Advanced Practice Nurse III (Schaal, Gentieu)

Credits 3
Prerequisite: NU 641

This course provides an introduction for the pediatric advanced practice nurse student to the conceptual basis in providing care for pediatric populations with common chronic conditions. This course will prepare the student to assume the role of a care provider, and to collaborate with members of the healthcare team in caring for children with chronic conditions. Sixteen hours per week of clinical practicum with a preceptor is required.

NU 672* Informatics for Advanced Nursing Practice (Schaal, Elkind)

Credits 3

This course is designed to introduce the advanced practice nurse to the present and potential impact of information technology on nursing systems and other health care systems. The course emphasizes the role of information technology in supporting the roles of care giver, administrative/financial manager, and client educator carried out by the advanced practice nurse in a variety of health care settings. The course provides both the knowledge base and the skills necessary to utilize current information technology.

NU 673* Comprehensive Assessment for Clinical Decision Making (Langner)

Credits 3

This course will enable the student to obtain and interpret data for development of a plan of care for patients in primary care settings. Emphasis is placed on taking a comprehensive health history, performing physical assessment, and utilizing laboratory and radiology findings to make differential diagnoses in primary care settings. This course includes didactic content and practice in the college laboratory, as well as in the hospital and a variety of health care settings.

NU 674 Management of Common Health Problems in Primary Care (Langner)

Credits 3
Pre- or Corequisites: PA or NU 570, NU 673, and ID 560

The course will introduce the student to principles of health promotion and disease prevention for children through middle age clients as applied in primary care. Alterations in health commonly treated in primary care settings will be addressed. Pathophysiological alterations, developmental stages, family, cultural and societal influences on the formulation of an individualized plan of care will be explored. Students will spend 16 hours per week in the clinical setting with a nurse practitioner or physician.

NU 675 Management of Women and Children in Ambulatory Care (Langner)

Credits 3
Prerequisite: NU 674

This course presents principles of primary care emphasizing health promotion and disease prevention for the child from birth through adolescence and for women. Pathophysiological alterations, developmental stages, family, culture, and societal influences on the formation of an individualized plan of care will be explored. Students will spend 16 hours per week in the clinical setting with a nurse practitioner or physician.

NU 676 Management of the Adult and the Older Adult in Ambulatory Care (Langner)

Credits 3
Prerequisite: NU 675

This course will focus on the complex issues relating to the management of adults and older adults in primary care settings. Principles of health promotion, health maintenance and disease prevention, as well as education to maximize self-care will be discussed. The distinct role of the nurse practitioner as a primary care provider and client advocate will be integrated into the discourse of how health care providers, clients and their families work together to manage chronic illness. Students will spend 16 hours per week in the clinical setting with a nurse practitioner or physician.

NU 681 Community Systems Administration I (Rose)

Credits 3
Prerequisite: NU 625

This course provides an overview of factors related to advanced population-based nursing with a focus on national health priorities and assessment strategies. Per week: 2 hours classroom; 16 hours practicum experience.

NU 682 Community Systems Administration II (Rose)

Credits 3
Prerequisite: NU 681

This course focuses on population-based nursing and public health concepts and theories that assist in providing interventions that improve the health of specific population subgroups. Per week: 2 hours classroom; 16 hours practicum experience.

NU 683 Community Systems Administration III (Rose)

Credits 3
Prerequisite: NU 682

This course focuses on theory and skill development for the interdisciplinary leadership/administrative role in population-based nursing practice. Per week: 2 hours classroom; 16 hours practicum experience.

NU 699 Independent Study (Schaal)

Credits 1-6

Provides an opportunity for students to investigate, in depth, an area in nursing related to their program goals. The independent study may consist of directed study, reading, or research under the guidance of a member of the Graduate Faculty. Students desiring to enroll in this course must have a proposal outlining their activities approved by their advisor. The depth and breadth of these proposed activities should be commensurate with the number of credits awarded. Methods of supervision, of content, and evaluation of the independent activity will be determined by the student and the faculty advisor.

GC 610 Strategic Management (Buescher, d'Arville)

Credits 3
Spring II

This course introduces the student to the Strategic Management Process as a base, to build on the basic management skills that the student has developed to date. The student will learn the nature and importance of planning; develop a "plan" for planning; relate planning to change management; and outline, investigate, and use the strategic management process. The student will learn to perform a situational audit, formulate program strategies and long and medium-range objectives, and learn the steps in strategic implementation.

ID 560* Advanced Pharmacotherapeutics (Lyons)

Credits 3

Examines selected topics in contemporary pharmacotherapeutics, such as hypertension, diabetes, infectious diseases and women's health issues. It enables the student to select appropriate drug therapy for a patient presented with one of the selected disease states and to develop a monitoring and outcome pharmacotherapeutic plan for the patient. It emphasizes the learning of rational decision-making skills in selecting drug therapy for patients of various social, economic, and cultural backgrounds.

ID 570* Financial Management of Healthcare Organizations (Lyons)

Credits 3
Prerequisites: ID 514, ID 526

Examines the financial environment of healthcare institutions including sources of revenue such as Blue Cross/Blue Shield, Medicare/Medicaid, and Health Maintenance Organizations. It examines alternate methods of financial capital investment in conjunction with capital expenditure controls.

PA 570* Pathologic Aspects of Disease (Fenderson)

Credits 3
Summer

The course will cover topics in general and systemic pathology, providing an overview of major aspects of human pathology and the pathophysiology of major diseases. Lectures supplemented with computer module containing case studies, clinical correlations and self-assessment components.

*Required Core Courses

Master of Science Program in Occupational Therapy

The Department of Occupational Therapy faculty prepare students to enter and continue in the profession of Occupational Therapy as qualified professionals who are able to address the complex issues that impact an individual's ability to engage in occupation. This perspective teaches students to consider the individual as having the ability to influence and be influenced by the human and non-human environments in ways which promote competence. Competence is recognized as the ability of individuals to carry on interactions with the environment, which result in their capacity to maintain, grow and flourish in their occupational roles.

Committed to excellence, students are encouraged to set professional and personal goals that foster their development as inquisitive practitioners and life-long learners. Graduates of the Occupational Therapy Master of Science Degree Program will possess the skills to improve occupational therapy practice through participation in research and by developing innovative models of occupational therapy practice. Jefferson graduates are able to assume a variety of professional roles, including those of practitioner, educator, leader, manager, consultant and program innovator. Through their advanced work in theory, research and clinical reasoning, graduates are prepared to provide leadership and scholarship in occupational therapy and related fields.

Goals And Objectives

Through a combination of academic study, research and field experience, individual pursuits, group activity and faculty mentoring each graduate student will develop:

- in-depth knowledge of the science of human occupation;
- ability to infuse occupation into practice as a means of maintaining and restoring health and well-being;
- understanding of the research process that enables the graduate to be an informed consumer and evaluator of research and to engage in research activities;
- knowledge of evidence-based decision-making and its use in the practice of occupational therapy;
- competence in evaluation and the ability to collaborate with patients and others in selection and implementation of appropriate treatment plans;
- skills to identify and develop new areas of practice, launch new programs in traditional areas of practice and meet emerging needs in health and wellness;
- knowledge and skills to become leaders and/or managers in practice, education, administration and/or research.

Beyond this common foundation, students will acquire knowledge, skill and experience relevant to their chosen concentration and personal/professional goals. These include:

- development of a personal framework for service delivery which integrates individual needs with occupational therapy intervention within a relevant social context;
- skills of critical inquiry, analysis and synthesis, all of which are basic to, and strengthened by experience in research and theory development and their applications to practice;
- ability to design intervention which promotes competence in individuals;
- appreciation of the complexity of human adaptation;
- life-long commitment to and appreciation of scholarship, research, and service.

The College of Graduate Studies offers the Master of Science Degree in Occupational Therapy with two routes of entry:

1). Entry-level Master's in Occupational Therapy (EMOT): A Master of Science degree program for persons holding a baccalaureate degree in another field who want to become occupational therapists and acquire advanced knowledge and competencies. The student's accelerated and competitive program begins in the fall and continues full-time for 28 consecutive months. It prepares the student for certification and clinical practice, leadership, and collaborative work in research. The students complete 83 credits at Jefferson, 36 of which are at the graduate level, and six months of clinical fieldwork during this 28-month period.

Program Approval/Accreditation.

The entry-level master's degree program is accredited by the Accreditation Council for Occupational Therapy Education (ACOTE). ACOTE can be contacted at the American Occupational Therapy Association, 4720 Montgomery Lane, PPO Box 31220, Bethesda, MD 20824-1220, (301)652-AOTA. Graduated from an accredited program are eligible to sit for the National Board of Certification in Occupational Therapy (NBCOT). After successful completion of this examination, the individual will be an Occupational therapist, Registered (OTR). Most states require licensure in order to practice; however, state licenses are usually based on the results of the NBCOT certification Examination.

2). Advanced Masters in Occupational Therapy. A Master of Science degree program for new or experienced occupational therapists and who want to acquire advanced knowledge and competencies. The Master of Science program may be completed on a full- or part-time basis over a period of up to five years.

Admissions Requirements

Applicants to either program must submit evidence of the following credentials:

1. A minimum Grade Point Average of 3.00 (on a 4.00 scale) earned at the baccalaureate level.
2. Acceptable performance on the Graduate Record Examination or the Miller Analogies Test.
3. Three references (two academic and one professional).

EMOT program admission requirements: satisfactory completion of a bachelor's degree in a discipline other than Occupational Therapy and completion of the following prerequisite courses is required for admission. Prerequisite Courses Required for EMOT Program are:

Anatomy and Physiology	8sh
General Biology	4sh*
Developmental Psychology	3sh
Abnormal Psychology	3sh
Cultural Anthropology or Ethnic Sociology or similar course work**	3sh
English	6sh
Statistics	3sh
Total Prerequisite Credits	26-30sh

*This course may be waived if grades in anatomy and physiology are "B" or better.

**This course may be completed prior to enrollment or during the summer between the first and second year of the program.

Advanced Master's program admissions requirements: satisfactory completion of a bachelor's degree and satisfactory completion of a course of study in an accredited program of Occupational Therapy leading to eligibility for certification as an Occupational Therapist Registered is required for admission.

Master's Program Requirements

For the EMOT Program in Occupational Therapy, baccalaureate level courses under the aegis of the College of Health Professions (CHP) are required for professional certification. In addition, graduate level courses offered through the Department, College and University are required for the EMOT degree. The EMOT curriculum, including graduate and undergraduate course requirements, is listed below. Undergraduate courses are 300 and 400 level courses. Graduate courses are 500 and 600 level courses and are indicated in bold. For the advanced master's degree, 36 credit hours of graduate course work are required.

Entry Level Master's Curriculum (Graduate level courses are in bold)		**Credits**
Fall, 1st Year		
OT 302	Applied Anatomy & Kinesiology (Lecture/Laboratory)	4
OT 311	Pathological Conditions	4
OT 321	Fundamentals of Occupation-Centered Practice, Laboratory I	1
OT 336	Occupation as a Life Organizer	3
OT 340	Introduction to OT w/FW	1
ID 310	Informatics	3
Semester Total		16

Spring, 1st Year

OT 308	Concepts in Neurodevelopment (Lecture/Laboratory)	4
OT 322	Fundamentals of Occupation-Centered Practice Laboratory II	1
OT 337	Occupation as a Life Organizer Laboratory	1
OT 341	Occupational Analysis and Evaluation - Level I Fieldwork	1
OT 353	Development of Human Competence	3
OT 357	Evaluation Process	3
OT 577	**Historical Perspective on OT Theory**	**3**
Semester Total		16

Summer, 1st Year

OT 458	Social Roles	3
OT 536	**Occupational Science**	**3**
OT 601	**Research Mentorship**	**1**
Elective/Independent study or specialty track course option		**(3)**
Semester Total		7-10

Fall, 2nd Year

OT 440	Fieldwork	1
OT 451	Adapting Environments Laboratory	1
OT 452	Occupational Therapy Interventions	3
OT 453	Occupational Therapy Interventions Laboratory	2
OT 467	Administration and Professional Development	2
OT 560	**Environmental Competence**	**3**
OT 603	**Research**	**3**
Elective/Independent study or specialty track course option (if not taken Summer I)		**(3)**
Semester Total		15-18

Spring, 2nd Year

OT 481	Fieldwork	3
OT 482	Fieldwork	3
Semester Total		6

Summer, 2nd Year

OT 578	**Clinical Problem Solving**	**3**
OT 602	**Data Collection and Analysis**	**2**
OT 682	**Clinical Leadership**	**3**
Elective/Independent study or specialty track course option		**(3)**
Semester Total		8-11

Fall, 3rd Year

OT 627	**Program Design and Evaluation**	**3**
OT 670	**Research Seminar**	**3**
Elective/Independent study or specialty track course options		**(2)**
Semester Total		6-8
CUMULATIVE CREDIT TOTAL		83

Undergraduate Credits = 47; Graduate Credits = 36

Total elective/independent study or concentration credits can not exceed 9 credits.

See Department Handbook for a complete listing of current course offerings in the Department and University.

Advanced Master's Curriculum

Required Courses		Credits
OT 536	Occupational Science	3
OT 601	Research Mentorship	1
OT 603	Research Design	3
OT 670	Advanced Seminar	3

Electives/Independent Study and Concentration courses may be taken from a variety of courses in the Department, College and University. Each Advanced Master's student will work with their faculty advisor to develop their individual program curriculum. Students are encouraged to select courses to fulfill degree requirements from Department and Interdepartmental Course offerings.

	Credits
Required Courses	10
Electives	8
Concentration	9
OT 689 or Independent Study	9
Total credits	36

Concentrations:

The Department offers advanced masters students the opportunity to concentrate their studies in a particular area of interest. Please contact the Department of Occupational Therapy directly for information regarding recognized areas of concentration and specific course offerings.

Faculty

Faculty expertise is drawn from the University, College of Graduate Studies, Jefferson Medical College, Thomas Jefferson University Hospital, College of Health Professions, and Department of Occupational Therapy faculty.

Graduate Faculty

Professors

PHILIPPA CAMPBELL, B.A., M.Ed., Ph.D., Kent State University, 1984: Child and Family Studies, early intervention, inclusion, training of occupational therapists and early childhood educators.

LAURA N. GITLIN, B.A., M.A., Ph.D., Purdue University, 1982: Community and home-based interventions to improve function of individuals and family caregivers; environmental modification; collaborative, interdisciplinary team research; dementia management.

Associate Professors

JANICE P. BURKE, B.S., M.A., Ph.D., University of Pennsylvania, 1996: Patient-therapist interaction; sociocultural communication; school age practice, theory development and leadership.

MICHELLE E. COHEN, B.A., M.Ed., Ph.D., Temple University, 1981: Spinal cord injury and outcomes assessment; rehabilitation; functional assessment and independence; community integration.

KEVIN J. LYONS, B.S., M.A., Ph.D., University of Maryland, 1975: Associate Dean, CHP; Associate Dean, CGS: Management and organizational behavior; leadership; and collaborative models of interdisciplinary research and care delivery.

Assistant Professor

SUSAN TOTH-COHEN, B.S., M.S., Ph.D., Temple University, 1999. Dementia caregivers, sociocultural factors in healthcare, learning and instruction.

Instructors and Adjunct Faculty

ROSEANN SCHAAF, B.S.; M.Ed.; Ph.D., Bryn Mawr College, 2001; Neurobiology and Behavior, Children with Sensory Integrative Dysfunction, Pediatric Occupational Therapy Practice.

SHELLEY WALLOCK, B.S., M.Ed., DrPH, University of Texas, 1985; School-based practice, transition from school to work, sensory integration.

Course Descriptions

OT 536 Occupational Science (Burke)

Credits 3

This course is designed to introduce students to occupational science and to guide their exploration of the components of occupational science. Students develop an understanding of the meaning of occupation in everyday life. The course focuses on the process by which humans develop and use conscious goals, intentions and repertoires of skills to enhance performance and develop competence to organize their lives through occupation. Qualitative methods are used to guide observations and collect information in the field.

OT 555 Older Adults and Their Living Environments (Toth-Cohen, Gitlin)

Credits 3

This seminar provides an in-depth and advanced understanding of older adults and the environments in which they live across the continuum of care. Through a combination of didactic and experiential learning opportunities, students will learn how to evaluate different environments (home, adult day care, nursing home) for their support or hindrance of occupational performance in older adults with a wide range of physical and cognitive conditions. Based on Lawton and Nahemow's competence environmental-press framework and Barris et al's model of environmental dimensions (objects, tasks, social groups and cultural beliefs, values), students will analyze the impact of age-related changes and environmental factors on occupational performance, an elder's personal sense of mastery and well-being. Analysis will occur at the theoretical, research, and clinical levels.

OT 560 Environmental Competence (Burke)

Credits 3

Overview of different approaches to understanding the development of environmental cognition, phenomenological explanations of behavior and environmental interactions, studies of nonverbal communication in the environment, and environmental theories. Students choose a patient or client population and setting to analyze performance using appropriate tools, and design an environment to improve the occupational performance of the people who use the setting.

OT 577 Historical Perspectives on Theory Based Practice in Occupational Therapy (Burke)

Credits 3

This course offers students an opportunity to understand the relationship between social, cultural and political forces in society and the profession of occupational therapy. Over the semester students will carefully examine how these external pressures have influenced the evolution of the field of occupational therapy with particular attention given to core and related concepts of occupation, competence, environment and adaptation. Concurrently, students trace the development of occupational therapy paradigms, models and theories as evidenced in the occupational therapy literature using methods associated with theoretical analysis. The concepts and constructs that form the basis of present practice models and theories will be identified, as well as those that may emerge and influence the future directions of the field. Students will compare the values, knowledge and skills reflected in these ideas and critique evidence of practice based and research based application. They will also have an opportunity to propose conceptual changes to existing theories and models.

OT 578 Clinical Problem Solving (Schaaf, Toth-Cohen)

Credits 2

Students will demonstrate their ability to initiate theory-based practice with specialized patient problems by selecting appropriate assessment instruments, establishing meaningful treatment goals and planning appropriate intervention that promotes functional performance in self-care, work, and leisure pursuits.

OT 601 Research Mentorship (Schaaf)

Credits 1

This mentorship provides an in-depth experience in how to formulate a research topic, conduct a literature search, critique research literature, develop a research question and write a literature review. Learning will occur through lectures, class discussions, readings, meetings with faculty mentors and assignments.

OT 602 Data Collection and Analyses (Toth-Cohen, Schaaf)

Credits 2

This course will use the prerequisite knowledge of statistics and the basic research process to address the process of data collection and data analyses for quantitative and qualitative research. Emphasis will be placed on the understanding of data collection techniques, data organization and storage, and data analyses (through the use of computer based programs). Research studies that are drawn from an interdisciplinary health perspective will serve as the focus for discussion. Learning will occur through lectures, class discussions, readings, demonstrations and assignments.

OT 603 Research Design (Toth-Cohen, Lyons)

Credits 3

Prerequisites: Matriculation in Master's OT program; OT 577, OT 536, and OT 601

Emphasis is on the acquisition of methods and techniques for extending the scientific base of knowledge for advanced nursing, physical therapy and occupational therapy practice. Interdisciplinary research studies serve as the focus of inquiry. Research designs and related statistical processes are examined in terms of their appropriateness for addressing various clinical problems. (Cross listed with NU 603 and PT 603)

OT 627 Program Design and Evaluation (Burke)

Credits 3

This course addresses the role of the health care provider as a program developer and evaluator as well as consultant. Students will develop knowledge and skill in the processes and techniques of theory-based program design and evaluation.

OT 670 Advanced Seminar (Schaaf, Toth-Cohen)

Credits 3

Prerequisite: OT 603

Students will explore in greater depth clinical research, issues involving methodology, questionnaire construction, data collection methods, outcomes measures, case studies and analytic strategies. Students will also learn how to prepare study results for publication.

OT 682 Clinical Leadership (Schaaf)

Credits 3

Students will create conceptual frameworks for guiding their learning about leadership in the clinic, in research, in community based practice and administration. Course will explore and expand knowledge and skills necessary to assume leadership roles in a wide range of practice and research arenas.

OT 689 Leadership, Innovations and Advanced Skills in Occupational Therapy (Burke, Schaaf, Toth-Cohen)

Credits Maximum of 9

The Department has an option for earning graduate credit for occupational therapy experience. Through this option, the student can translate clinical experiences, courses and/or special training into college credits.

OT 699 Independent Study (Burke, Schaaf, Toth-Cohen)

Credits 1-6

Students will carry out an analysis of an area of personal scholarly interest using their individual learning styles. Working with a faculty advisor, the student will identify a specific area of interest, establish learning objectives, and determine a structure to complete the objectives. This is a scholarly process that may include a literature review, systematic observation of a given phenomena, and analysis and/or integration of data.

Please contact the Department of Occupational Therapy directly for a complete list of additional course offerings. Phone 215-503-8010.

Master of Science Program in Pharmacology

The Master of Science Program in Pharmacology represents a 40 credit curriculum designed to prepare science majors (biology, chemistry, or other related sciences) for leadership positions in the area of pharmacology. The program will also prepare interested students for advanced graduate or professional degree programs. The primary emphasis of this program is to prepare its graduates for challenging new careers which call for advanced scientific knowledge, and skills and competency in management. Students will be trained in molecular pharmacology, biochemistry, clinical pharmacology, biostatistics, as well as business administration, and will complete a master's research thesis. Students will be able to select one of several areas for specialized training which will prepare them for positions in areas such as: academic or industrial pharmacology research, clinical research management, medical or environmental toxicology, or health care services.

Conceptual and technical advances in pharmacology have increased opportunities for Master of Science graduates in health care institutions and in corporations. There are at present, shortages among all levels of non-physician clinical research associates, molecular pharmacology research associates, medical and environmental toxicologists, and there is every indication that new career opportunities will continue to develop. Nationwide, health related careers await graduates from Master of Science programs of high academic quality. Recent surveys indicate that the demand for B.S. and M.S. graduates has greatly increased, in part, at the expense of Ph.D. graduates.

Applicants for admission to the program must possess a baccalaureate degree in biology, chemistry, or other related science, and must meet the admissions requirements of the College of Graduate Studies. Requirements include satisfactory performance of the verbal and quantitative portions of the Graduate Record Examination, and an undergraduate cumulative grade point average predictive of success in graduate school. Students without a strong undergraduate background in the life sciences will be required to complete undergraduate courses in biology, chemistry, and college mathematics at an accredited institution prior to enrolling in the graduate level science courses.

The program is designed to be completed on a part-time basis with the option of full-time study. Students must earn 40 credit hours from course work, including a master's level research thesis. Part-time students will be able to complete the program in two to four years.

This program has been designed with a core science curriculum and a series of specialty tracks which will optimally prepare students to pursue their individual career goals. The tracks include 1) molecular pharmacology, 2) clinical pharmacology, 3) clinical toxicology, 4) clinical research scientist and 5) experimental therapeutics. Graduates of the Master of Science Program in Pharmacology will also have exposure to principles of ethics in medicine and science, health policy and clinical outcomes research, and the management and communication skills needed in their future careers.

Administration

Inquiries on the program should be directed to Georganne Buescher, Ed.D., Associate Dean, Georganne.Buescher@mail.tju.edu or Karen Dohm, Ph.D., Academic Coordinator Karen.Dohm@mail.tju.edu, room M-46, Jefferson Alumni Hall, (215) 503-5799.

Program Director: Gerald Litwack, Ph.D., Chairman, Department of Biochemistry and Molecular Pharmacology

Track Directors:		
I	Molecular Pharmacology	Gerald Litwack, Ph.D.
II	Clinical Pharmacology	Scott Waldman, M.D., Ph.D.
III	Clinical Toxicology	Frederick Rieders, Ph.D.
IV	Clinical Research Scientist	Scott Waldman, M.D., Ph.D.
V	Experimental Therapeutics	Timothy Block, Ph.D.
VI	Human Investigation	Scott Waldman, M.D., Ph.D.

Program Requirements

Required Courses

		Credits
PR 522	General Pharmacology	3
PR 525	Clinical Pharmacology	3
BI 550	Topics in Medical Biochemistry	3
GC 660	Statistical Methods of Data Analysis	2
PR 720	Seminar (Section 2)	1
PR 810,820,830	Clerkship	6 total
PR 870,880,890	Master's Thesis Research	6 total
Select courses in Management:		6 Minimum
GC 515	Quality Measure/Outcomes Analysis In Health Care	3
GC 525	Information Systems in Organizations	3
GC 600	Management Skills	3
GC 605	Performance Improvement	3
GC 610	Strategic Management	3
GC 620	Fundamentals of Financial Management	3
GC 621	Biotechnology Venture Management	2
GC 622	Cases in Financial Management	3

Recommended Electives and Specific Track Courses (a partial list)

GC 510	Database Design and Management	2
GC 526	Presentation Skills	2
GC 529	Laboratory Animal Sciences	2
GC 535	Introduction to Genomics and Bioinformatics	2
GC 615	Grant Management	2
GC 625	Drug Development Issues	2
GC 630	Fundamentals of Clinical Trials	3
GC 635	Fundamentals of Clinical Trial Management	2
GC 640	Research Ethics and Responsible Conduct	1
GC 650	Pharmacoeconomics	3
GC 655	Clinical Epidemiology	2
GC 670	Experimental Design in Research	2

GC 680	Laboratory Techniques in Molecular Biology	2
GC 690	Regulatory Issues in Scientific Research	2
GC 720	Scientific Writing	2
GE 652	Molecular Basis of Cancer	2
MI 521	Introduction to Immunology	2
MI 580	Principles of Epidemiology	2
MI 582	Diagnostic Microbiology	4
PA 570	Pathologic Aspects of Disease	3
PR 530	Fundamentals of Biosafety	2
PR 613	Protein Structure and Function	3
PR 625	Animal Pharmacology	3
PR 630	General Toxicology	3
PR 635	Clinical Pharmacotoxicology	3
PR 636	Experimental Therapeutics	3
PR 680	Molecular Pharmacology	3
PR 760	Case Studies in Clinical Pharmacology	2

Completion and presentation of an M.S. Thesis are required for each track.

Graduate Faculty

Professors

GERALD LITWACK, B.A., M.S., Ph.D., University of Wisconsin, 1953: Chairman of the Department of Biochemistry and Molecular Pharmacology; Vice Dean for Research, JMC; Biochemistry and molecular biology of glucocorticoid and mineralocorticoid receptors and associated immunophilins; mode of action and structure of modulator and glucocorticoid-induced programmed cell death.

ARTHUR ALLEN, B.A., M.A., Ph.D., Temple University, 1956: Interrelationships between carbohydrate and lipid metabolism.

JEFFREY L. BENOVIC, B.S., Ph.D., Duke University, 1986; Director of Graduate Program in Molecular Pharmacology and Structural Biology; Molecular and regulatory properties of G protein-coupled receptors; elucidation of the role of G protein-coupled receptor kinases and arrestins in receptor regulation.

TIMOTHY M. BLOCK, B.A., Ph.D., State University New York at Buffalo, 1979: Director for the Jefferson Center for Biomedical Research at Delaware Valley College; Herpes virus latency, molecular mechanisms of herpes virus pathogenesis, and hepatitis B & C virus morophogenesis; analysis and pursuit of antiviral agents, glycovirology; proteomics as a diagnostic tool.

GERALD B. GRUNWALD, B.A., M.S., Ph.D., University of Wisconsin, 1981, Associate Dean CGS, Director of Graduate Program in Developmental Biology and Teratology; Developmental biology, neuroscience; analysis of cell-cell interactions during development of the nervous system and the eye; studies of regulation of cadherin cell adhesion molecule expression and function in development and disease using biochemical, cell biological, immunological and molecular genetic methods.

SCOTT A. WALDMAN, B.S., Ph.D., M.D., Stanford University,1987: Molecular mechanisms of signal transduction with special emphasis of the coupling of peptide ligand-receptor interactions to activation of effector mechansims.

ALLEN R. ZEIGER, B.A., Ph.D., Johns Hopkins University, 1967: Opioid receptors and immune function; opiate metabolism.

Research Professor

JAMES J. DIAMOND, B.S., M.S., Ph.D., Syracuse University, 1970: Statistics, research methods.

Honorary Professor

JAMES J. KOCSIS, B.A., M.S., Ph.D., University of Chicago, 1956: Regulation of metabolism to biological activity of natural products (taurine and prostaglandins) and foreign compounds (CCI4, benzene, chlorinated benzenes and DMSO). Relation of metabolism of salicylates to toxicity.

Associate Professors

BRUCE A. FENDERSON, B.S., Ph.D., Johns Hopkins University, 1980: Mechanisms of morphogenesis and malignancy; role of cell surface carbohydrates in developmental processes and differentiation; the glycolipids of human germ cell tumors and the role of hyaluronan in regulating cell migration.

CHARLENE J. WILLIAMS, B.A., Ph.D., Rutgers and the University of Medicine and Dentistry of New Jersey, 1983: Genetic linkage analysis of osteo- and inflammatory arthropathies; positional cloning of disease susceptibility genes for osteo- and inflammatory arthropathies; isolation and characterization of genes in normal and diseased cartilage; molecular ecology.

Clinical Associate Professor

DAVID NASH, M.A., M.D., M.B.A., The Wharton School, University of Pennsylvania, 1986: Health policy and clinical outcomes; pharmacoeconomics.

Adjunct Associate Professor

DENNIS M. GROSS, B.A., M.Sc., Ph.D., University of California, Los Angeles, 1974: Scientific strategist and operations expert. Drug discovery process; which elements of chemistry, biology, molecular biology, must be brought together in a cohesive effort in order to bring new drugs from bench to bedside.

Clinical Assistant Professor

GEORGANNE K. BUESCHER, B.S., M.S., Ed.D., Temple University, 1984: Diagnostic microbiology; rapid methods of identification, curriculum development.

Research Assistant Professors

NOREEN M. ROBERTSON, B.A., D.M.D., Temple University School of Dentistry, 1990: Defining molecular mechanisms involved in eosinophil apoptosis; elucidation of the role of tumor necrosis family members in airway inflammation in asthma.

STEPHANIE SCHULTZ, B.S., Ph.D., University of Vermont, 1987: Molecular characterization of guanylyl cyclase receptors; structure/function analysis, signal transduction mechanisms, and regulation of gene expression.

Adjunct Assistant Professors

FRANK BARONE, B.A., Ph.D., Syracuse University, 1978: Discoveries in stroke and neuropharmacology.

MARGARET LANDI, B.A., M.S., V.M.D., University of Pennsylvania, 1979: Laboratory animal medicine; study of animal models of human diseases.

Adjunct Clinical Assistant Professors

JEROME G. BUESCHER, B.A., Ph.D., Thomas Jefferson University, 1981: Clinical microbiology; rapid methods, cost containment measures; quality assurance; rational test utilization.

ROBERT A. MIDDLEBERG, B.A., M.S., Ph.D., Thomas Jefferson University, 1991: Forensic toxicology; analysis of biological fluids and tissues for the presence of toxicants capable of causing death or affecting human performance; development of analytical methods for toxicants; interactions of science and the law.

Course Descriptions

PR 522* General Pharmacology (Waldman)

Credits 3
Fall

Introduction to the basic principles of drug action, including molecular mechanisms, time and dose dependency of drug actions, pharmacokinetics, toxicity, resistance and tolerance, pharmacogenetics, mutagenesis, carcinogenesis, and drug development and evaluation.

PR 525* Principles of Clinical Pharmacology (Waldman)

Credits 3
Spring I

The objectives of this course are to present the principles of clinical pharmacology and practical therapeutics, including understanding and application of basic pharmacokinetic principles, basic pharmacodynamic principles, drug regimen design, therapeutic drug monitoring, adverse drug reactions, drug discovery and drug developments, principles of clinical study designs, biostatistics and pharmacology analysis.

PR 530 Fundamentals of Biosafety (Grunwald, Souder)

Credits 2
Spring I

The purpose of this course is to provide students with a basic knowledge of biosafety as related to good laboratory practice. The course will begin with an introduction to Federal biosafety regulations, guidelines and standards, the role of the Biological Safety Officer in the institution and the epidemiology of laboratory-associated infections. Students will become familiar with: concepts in biotechnology and cell biology; means of exposure to biohazardous agents; hazard assessment in the laboratory; laboratory design criteria when using biohazardous agents; good laboratory practice, (GLP); decontamination, sterilization, disinfection and proper disposal of infectious waste; packaging and shipping of biohazardous material; biosafety training design and implementation; and special considerations related to gene therapy.

PR 613 Protein Structure and Function - Structural Biology I (Wickstrom)

Credits 2
Prerequisite: BI 515, BI 525 or permission of instructor
Spring I

This course is designed to train the graduate student in current methods used in the field of protein structure determination. Experimental techniques to be covered include X-ray crystallography and diffraction techniques, magnetic resonance spectroscopy (NMR and EPR), optical spectroscopy (UV/VIS, circular dichroism), and fluorescence spectroscopy. The use of computers and computer modeling in data analysis will also be emphasized. Various proteins, protein systems, and enzymes will be examined.

PR 625 Animal Pharmacology (Barone, Landi)

Credits 3
Fall

This course provides basic training for M.S. and Ph.D. students in animal pharmacology. The specific goals of the course are: 1) to provide basic principles of *in vivo* drug experimentation conducted on anesthetized and conscious animals. Principles of animal anesthesia, surgical procedures, pre- and post-operative care will be studied along with regulatory and ethical aspects of experimentation on small and large laboratory animals, 2) to provide basic knowledge and insights on animal models of human disease and the scientific and technical issues associated with the use of laboratory animals in drug development. Principles of pharmacodynamics and pharmacokinetics will be introduced, along with major organ and systemic pharmacology of the heart, kidney, brain, blood vessels, and the pulmonary system, 3) to provide an opportunity to acquaint students with modern pharmacology research in an industrial set-up and the fundamentals of the processes of drug discovery.

PR 630 General Toxicology (Middleberg)

Credits 3
Summer

This course will introduce students to the principles and practices of Toxicology. Emphasis will be given to the comprehensiveness of toxicology as opposed to individual academic interests. While introductory courses in biochemistry, physiology, anatomy, and pharmacology would be helpful, they are not necessary since each topic will be covered as an introduction to the subject matter.

PR 635 Clinical Pharmacotoxicology (Kocsis)

Credits 3
Spring I

This course gives the student an understanding of the concepts, knowledge, and skills which provide the basis for applications such as effectively providing consultative and laboratory testing services. Students will also become familiar with other aspects of pharmacotoxicology, such as research and development, quality assurance/quality control, education, and training relating to prevention, diagnosis, and treatment; forensic and regulatory aspects of harmful/toxic effects of exogenous chemicals.

PR 636 Experimental Therapeutics (Block)

Credits 3
Fall

This course is intended to be an advanced course in which students will learn about experimental and emerging therapies for human disease and the methodologies leading to their discovery and development. The course will begin with an overview of molecular biology as it relates to the drug process. The role of the pre-clinical and clinical investigations of candidate compounds will then be considered. Key developments and approaches in conventional and non-conventional drug design, representative of experimental therapeutics, will be analyzed on a topic-by-topic basis, where the pharmacological and basic science perspective of each topic can be evaluated.

PR 680 Molecular Pharmacology (Benovic)

Credits 3
Prerequisite: PA 510 or BI 550
Spring II

This course focuses on regulation of cell function through an understanding of hormone, neurotransmitter and drug action at the molecular level. Specific emphasis will be placed on the mechanisms by which cell surface receptors, GTP binding proteins, effector enzymes and ion channels mediate signal transduction in the cell.

PR 720* Seminar - Section 2 (Kocsis)

Credits 1
Spring I

Presentation of research reports and review of special topics by faculty, graduate students, and speakers invited from other institutions.

PR 760 Case Studies in Clinical Pharmacology (Waldman, Greenberg)

Credits 2
Spring II

This course examines the application of Clinical Pharmacology fundamentals employing a practical, case-oriented approach. Employing real-life cases, the problem solving will be more realistic, and the learning better reinforced. This "case approach" has been used in leading medical and business schools for many years. The fundamental topics of clinical pharmacology that were initially presented in Pharmacology 525 or 401 will be applied here in clinical scenarios to reinforce the educational process. These include pharmacokinetics, pharmacodynamics, therapeutic drug monitoring, drug interactions, drug metabolism, adverse drug reactions, pharmacogenetics, elements of biostatistics and clinical trials, and dosage regimen design.

PR 810, 820, 830* Laboratory Clerkship (G. Buescher)

Credits 1-6

Students will gain experience and proficiency in the practical application of molecular pharmacology, clinical pharmacology, clinical toxicology, or clinical research science. Students will receive training in the clinical and research pharmacology or toxicology laboratories of the University as well as selected affiliate laboratories, where appropriate. The specific focus of training and the training site selected for this experience will vary depending upon the student's prior experience, needs, and career goals.

PR 870, 880, 890* Master's Research (G. Buescher)

Credits 1-6

Students will gain experience and proficiency in the formulation of research questions, scientific experimentation, analysis of laboratory data, and the writing of a scientific manuscript.

BI 550* Topics in Medical Biochemistry (Allen)

Credits 3
Fall

This lecture course presents the standard topics of biochemistry and molecular biology. In addition, emphasis is placed on explaining how certain abnormal biochemical events can account for the development of certain diseases. The course also provides useful background material for some of the subsequent courses taken in the Master of Science programs in the basic sciences.

GC 510 Database Design and Management (Waldman, Leone)

Credits 2
Summer

This applied, "how to" course lays the groundwork for an object-oriented approach to relational database development. The approach focuses on identification, formalization, and verification of study data. Students will learn how to collect and organize information into well-developed objects and relationships. Students will have the opportunity to perform statistical analyses on several real data sets using general-purpose statistical software packages. The course will also introduce students to Epi Info®, a public domain epidemiologic database and analysis application.

GC 515 Quality Measure/Outcomes Analysis In Health Care (Nash, Goldfarb)

Credits 3
Fall

The course will cover methods for quality measurement and improvement, application of these methods in various settings and populations, and current and future directions in quality. Student will develop an understanding of issues in defining and measuring quality of care in a variety of health care settings, and learn the skills to measure quality and analyze outcomes.

GC 525 Information Management (Bross)

Credits 3
Maximum number of students 15
Fall, Spring II

This course is designed to provide a detailed understanding of information systems and their use within the modern organization. It will explore the essential components of the systems and analyze how each is developed and linked into a production system. Contemporary computing concepts will be examined and a profile of strategic information management issues will be presented. Particular emphasis will be placed on the role of technology in assisting organizations to meet their operational and strategic goals. The course incorporates Internet activities, spreadsheets, and a database management package.

GC 526 Presentation Skills (Buescher, Scott)

Credits 2
Maximum number of students 16
Spring I

This course focuses on skills needed to make successful oral presentations, and poster presentations. Although no specific prerequisite courses are required, the nature of this course demands that students be at a point in their careers where they are prepared to make both an oral and poster presentation on a topic germane to their interests.

GC 529 Laboratory Animal Sciences (Jepsen)

Credits 2
Spring II

This course will introduce students to laboratory animal science. Topics will concern regulations and their effect on the care and use of laboratory animals, the biology, husbandry, and diseases of common laboratory animal species, ethical and scientific issues, experimental surgery and animal research techniques.

GC 535 Introduction to Genomics and Bioinformatics (Williams, Pellini)

Credits 2
Spring I

This course introduces the principles of medical genetics to graduate students who require a working knowledge of modern molecular genetics. The first half of the course will provide students with a background for understanding the genetics of disease. Topics to be reviewed will include: the chromosomal basis of heredity; the structure and function of genes and chromosomes; and the patterns of single and multifactorial inheritance. The second half of the course will acquaint students with the newly emerging fields of study as a result of sequencing projects (Bioinformatics, Proteomics and Pharmacogenomics) and explore the potential career opportunities in these areas. Several presentations will also be devoted to accessing DNA and protein analysis programs through the Internet, so that the student can gain hands-on experience navigating web-based information tools and extracting information from the growing number of databases available to biomedical researchers.

GC 600 Management Skills (G. Buescher, Arsenault)

Credits 3
Maximum number of students 25
Fall

This course introduces current theories and concepts of leadership and management and develops the skills necessary to successfully perform as a manager and leader. Based on input from focus groups with representatives from the pharmaceutical, biotechnology and healthcare industries, the course gives special emphasis to developing skills for collaboration, improved communication, problem solving, managing change, and reengineering.

GC 605 Performance Improvement (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Fall

This course introduces the principles and concepts of Performance Improvement, (similar to the concepts of Total Quality Management, TQM). Emphasis will be on the importance of employee involvement and critical nature of customer focus. Material will demonstrate why performance improvement is so important in any industry and how these principles and concepts can be applied. It will

provide an orientation to the analytical tools used in performance improvement projects, and apply them to real work situations. Students will differentiate between the role of the project team and the role of line management. Class will discuss national quality awards and benchmarks.

GC 610 Strategic Management (Buescher, d'Arville)

Credits 3
Spring II

This course introduces the student to the Strategic Management Process as a base, to build on the basic management skills that the student has developed to date. The student will learn the nature and importance of planning; develop a "plan" for planning; relate planning to change management; and outline, investigate, and use the strategic management process. The student will learn to perform a situational audit, formulate program strategies and long and medium-range objectives, and learn the steps in strategic implementation.

GC 615 Grant Management (Grunwald)

Credits 2
Summer

This course is designed to serve as an introductory overview of the pre- and post-application procedures that relate to the writing, submission, review, award, and management of research grants. The areas included will be covered from both the perspective of the principal investigator as well as from the administrative viewpoint.

GC 620 Fundamentals of Financial Management (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Spring I

The purpose of this course is to introduce the non-financial manager to financial systems, principles of accounting and their relationship to basic business activities. These concepts will be relevant to the research laboratory and discussion will center on basic financial statements and their analysis, financial planning, business language, and concepts, preparation and interpretation of financial statements. The use of electronic worksheets will also be incorporated in the analysis of case studies.

GC 621 Biotechnology and Venture Management (Saukkonen, Chou)

Credits 2
Summer

Students will be taught how to identify and analyze the factors that contribute to the creation of successful new business ventures. They will learn to consider the management problems associated with the founding of a new enterprise, either as a small business or as a part of an existing corporation. They will discuss the concepts and use the methodologies for putting together a successful business plan. Emphasis in the course will be on technology-based innovation.

GC 622 Cases in Financial Management (Buescher, Chatterton)

Credits 2
Prerequisite GC 620 or permission of instructor
Maximum number of students 8
Fall

The course is designed to provide a Case Study approach for the implementation skills learned in GC 620. Students will work as Department Managers in a health care or academic "case" organization reviewing monthly financials, recommending actions based on their review, and preparing an annual budget. Students will complete a formal budget presentation and "defense" and attend mock meetings of department heads with the instructor acting as CEO or CFO of the organization.

GC 625 Drug Development Issues (Gross)

Credits 2
Summer

This course explores the drug development process primarily at steps post-basic research. The course will examine the domestic and international regulatory environment, current requirements, and new drivers in the development process, specifically outcomes of research and pharmacoeconomics.

GC 630 Fundamentals of Clinical Trials (Hauck)

Credits 3
Minimum number of students 12
Maximum number of students 20
Fall

This course introduces students to the fundamentals of clinical trials, from choosing a question and writing a protocol, through running a trial, to analyzing and reporting results. Key topics include how to assure validity in trials, what to include in a protocol, quality assurance of ongoing trials, statistical methods for analyzing trials, and how to review critically the reports of trials.

GC 635 Fundamentals of Clinical Trial Management (Saukkonen, Lata)

Credits 2
Spring I

This course introduces key principles and practical applications for the development of new pharmaceutical compounds. It will 1) introduce the student to the total clinical research process from the perspective of the current Good Laboratory Practices (GLP) and the current Good Clinical Practices (GCP), including specific global regulatory guidelines frame-working the development and approval of new pharmaceuticals; 2) focus on the responsibilities and effective interactions between the investigating research site and the various regulatory entities charged with ensuring the protection of the human research subject as well as the overall integrity of the clinical trial and the sponsor; 3) ensure that the student will be able to relate "real world" experiences and techniques to regulatory requirements, necessary to effectively prepare for and conduct a variety of clinical trials from the perspective of the investigator and sponsor.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 650 Pharmacoeconomics (Nash, Lofland)

Credits 3
Spring I

This course provides a thorough introduction to the field of pharmacoeconomics and disease management. Beginning with the basics such as reasons for study, the challenges facing experts, and the significance of the science, the course will propel students through the practical knowledge necessary to embark on current, valid, comprehensive studies. Cost benefit, cost utility, cost effectiveness methods will be defined in detail. Accounting and finance will be integrated with statistics and database skills. Students will learn how to use available technology to their advantage and will gain hands-on experience by conducting case studies of their own. In addition, the course includes a general introduction to managed care, including all relevant terminology, government institutions, current public policy, and varying viewpoints of experts in the field.

GC 655 Clinical Epidemiology (Waldman, Weinberg)

Credits 2
Prerequisite: MI 580 or permission of the instructor
Fall

The goal of this course is to introduce how basic epidemiologic and biostatistical techniques, useful in describing the determinants of disease in a population, can be used to answer specific clinical questions. Topics to be considered include issues of study design, cost-effectiveness and critical appraisal of the literature.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have opportunity to use a computer package for analysis.

GC 670 Experimental Design in Research (Diamond)

Credits 2
Prerequisite: GC 660 or permission of instructor
Spring II

The purpose of this course is to have students apply the principles and techniques of basic statistical analysis specifically to development of clinical research protocols. Lecture and workshop sessions will be used to gain an in-depth understanding of the issues relating to experimental design and conduct.

GC 680 Laboratory Techniques in Molecular Biology (Buescher, Kuo)

Credits 2
Maximum number of students 16
Fall, Spring II

The purpose of the course is to introduce the students to basic techniques in molecular biology, including genetic engineering. Beginning with an introduction to the biological significance of DNA and the fundamentals of good laboratory practices, students will become familiar with: purification and characterization of nucleic acids; cloning vectors, enzymes used in DNA cloning, and *E. coli* host strains; principles of restriction mapping, recombinant library construction, and the polymerase chain reaction; production and use of nucleic acid probes in hybridization to filter-immobilized DNA. Students will be instructed in the biochemical and biological concepts involved in the selected molecular biology techniques so that, at the completion of the course, students will have the ability to work through technical problems in this "kit-oriented" era, and to assimilate new techniques as they arise.

GC 690 Regulatory Issues in Scientific Research (Smith)

Credits 2
Spring II

The course is designed to familiarize students with regulations governing scientific research, specifically research involving human subjects. Lectures and discussions will focus on the history of regulations governing human subject research, regulations protecting human research subjects, regulations concerning the development of new drugs and devices, and regulations dealing with the use of ionizing radiation, isotopes, recombinant DNA, and gene therapy.

GC 720 Scientific Writing (Buescher, Dohm)

Credits 2
Summer

This course concentrates on the process of writing the dissertation/thesis or research paper and on the effective presentation of scientific information. Students will learn to write the sections of a research paper or thesis and will develop skills with various pieces of productivity software such as word processors, spreadsheets and statistical packages. Students will learn how to create sophisticated documents to improve communication of scientific information.

The course emphasizes a reader-oriented approach to writing, critical analysis of good biomedical writing, and strong presentation of data and ideas. Some time will also be spent on principles of effective oral presentations.

GE 652 Molecular Basis of Cancer (Donovan)

Credits 2
Spring II

This advanced seminar course emphasizes the molecular and genetic basis of neoplasia, including oncogene activation, tumor suppressor genes, chromosomal translocation and deletions. Models of multistep tumorigenesis in transgenic mice.

MI 521 Introduction to Immunology (J. Buescher)

Credits 2
Fall

This course introduces the students to the immune system as an adaptive defense system that recognizes invading pathogenic organisms and mounts a response to eliminate or neutralize foreign infectious agents. The students will be introduced to the molecules, the cells, and organs, and the processes involved in host defense against infection. An overview of basic principles, concepts, and techniques used to assess immune status will be presented.

MI 580 Principles of Epidemiology (G. Buescher, Robbins)

Credits 2
Spring II

This course will present the science of epidemiology using examples from the whole field of pubic health. Beginning with the basic concepts the course will include examples of the broad range of modern applications of epidemiology. Students will become familiar with the role of epidemiology as applied in environmental/occupational medicine, pharmaceuticals, health outcomes research, infectious diseases and cancer care.

MI 582 Diagnostic Microbiology (J. Buescher)

Credits 4
Fall

The purpose of this course is to introduce students to the fundamental elements underlying all subsequent learning in microbiology. These elements will be taught within the setting of medical microbiology. Learning microbiology within that format will give students the additional benefit of becoming familiar with the terms and constructs of clinical medicine.

PA 570 Pathologic Aspects of Disease (Fenderson)

Credits 3
Summer

The course will cover topics in general and systemic pathology, providing an overview of major aspects of human pathology and the pathophysiology of major diseases. Lectures supplemented with computer module containing case studies, clinical correlations and self-assessment components.

*Required core courses.

Master of Science Program in Physical Therapy

This program is designed to prepare physical therapists whose knowledge base and clinical skills are appropriate for current and future practice to meet society's health care needs. The curriculum is based upon a clinical problem-solving approach to education integrated with a health and wellness model.

The Master's program will allow students to integrate theory, practice and research within an interdisciplinary problem-solving approach. Students will apply scientific knowledge, humanistic values, critical analysis and a systematic approach to solving problems.

Students enter the program after the completion of **59** prerequisite credits. The program is three years in length and builds upon the student's knowledge in the biological, social, behavioral, and natural sciences. An important culminating experience is a professional research paper, which the student submits for publication in a professional journal. The first and second years are primarily undergraduate course work taken in the College of Health Professions. The third year of the program is Master's level course work taken in the College of Graduate Studies. Upon successful completion of the program, the graduate will be awarded both the Bachelor of Science Degree in Physical Therapy and the Master of Science Degree in Physical Therapy. The three-year program is jointly administered by the College of Health Professions, which admits students as a college junior, and by the College of Graduate Studies, to which they are admitted for the third year of the program.

Admissions Requirements, Master of Science in Physical Therapy (Graduate portion)

1. A student seeking admission into the Master of Science Degree Program in Physical Therapy must have been a student in good standing in the undergraduate Physical Therapy program at Thomas Jefferson University.
2. In order to be considered for entry to the graduate phase (third year) of the program in the College of Graduate Studies, a student must have achieved a minimum cumulative grade point average of 3.00 (on a 4.00 scale). The GPA will be based solely on courses taken in, or approved by, the Physical Therapy Program of Thomas Jefferson University.

Program Requirements

Required Courses

		Credits
PT 501	Health Care Delivery Systems	2
PT 515	Geriatric Physical Therapy	3
PT 505	Analysis of Human Motion	3
PT 530	Prosthetic and Orthotic Interventions	3
PT 551	Pediatrics	4
PT 560	Neurological Physical Therapy II	3
PT 604,605	Research Seminar I, II	3 each
PT 690,692	Clinical Affiliation III, IV (8 weeks each)	4 each
ID 612	Primary Health Care	3
ID 614	Clinical Decision Making	1
Electives (Must be 500 or 600 level)*		6

*PT 699 (Independent Study - 3 credits) must serve as the elective for either Fall or Spring semester.

Completion and presentation of a research paper or project, to be submitted for publication in a professional journal, is required by the end of the Spring semester.

Faculty

Faculty expertise is drawn from the College of Graduate Studies, College of Health Professions, and Department of Physical Therapy Faculty.

Graduate Faculty

Associate Professors

MARGARET RINEHART AYRES, B.S., M.S., P.T., Ph.D., Temple University, 1997: Director of Graduate Program in Physical Therapy; Spinal cord injury; cancer, lymphedema and quality of life; clinical education

MARCUS P. BESSER, B.S., M.S., Ph.D., Drexel University, 1991: Acting Chair of the Department of Physical Therapy; Biomechanics; analysis of human movement; gait analysis; balance and falling; predicting risks of falling in the elderly and evaluating balance in persons with spinal cord injuries.

JAN BRUCKNER, A.B., M.S., P.T., Ph.D., Indiana University, 1993: gait research; prosthetics & orthotics; subtalar variations; foot care.

PAUL HOWARD, B.A., B.S., M.A., P.T., CertMDT, Ph.D., 1991: orthopaedic physical therapy, manual therapy, clinical anatomy.

JULIE MOUNT, B.A., M.A., P.T., Ph.D., Temple University, 1994: Postural adjustment and motor skill learning; motor control of individuals with central nervous system dysfunction; neurological rehabilitation.

Assistant Professor

STAN DACKO, B.A., M.S., P.T., Ph.D., Hahnemann University, 1997: Motor control; Neurobiology of muscle fatigue; strength and endurance training for individuals with central nervous system dysfunction.

Course Descriptions

All courses are required.

PT 501 Health Care Delivery Systems (Besser, Cullen)

Credits 2

Provides information concerning the physical therapist's responsibility in the management of the physical therapy department within a health care system. Areas include financial considerations, supervision and leadership skills, hospital administration and socioeconomic aspects of health care.

PT 505 Analysis of Human Motion (Mount)

Credits 3

Advanced study of the neurophysiological principles underlying human motion with special attention to the application of principles to examine and evaluation of normal and abnormal motion. Examination of theoretical concepts that attempt to explain motor control. Examination of principles of motor learning and task analysis, and their application to rehabilitation, patient and family education. Evaluation of neurophysiological techniques to improve the quality of motion.

PT 515 Geriatric Physical Therapy (Mount, Pricket)

Credits 3

Examines the effects of age on physiological, psychological and social status and how these changes impact on health management. Consists of practical and didactic components. Students work one-on-one providing health screening and counseling to individuals in the community. During discussion sessions, students engage in group analysis and problem solving related to their practicum. Students implement the solutions, then provide the class with feedback on the effectiveness of the solution.

PT 530 Prosthetic and Orthotic Interventions (Bruckner)

Credits 3

Examines application of prosthetics and orthotic components, alignment, fabrication and fitting with emphasis on the lower extremity. Includes gait analysis and exercise programs.

PT 551 Pediatrics (Bruckner)

Credits 4

Presents physical therapy management of pediatric patients, including normal motor development and client examination, evaluation and intervention to improve function and limit disability.

PT 560 Neurological Physical Therapy II (Mount)

Credits 3

Presents the management of complex patients with central nervous system dysfunction (e.g., traumatic brain injury and multiple sclerosis). Discusses impact of perceptual changes, cognitive changes, behavioral changes and changes in motor output; addresses the interface of the client with the environment. Students examine, evaluate and provide intervention to a patient with a brain injury in a rehab setting and make three visits to an individual with multiple sclerosis to assess and modify the home and teach strategies for functioning within the home.

PT 604 Research Seminar I (Besser)

Credits 3

The next step in the research process that began in ID 302: Understanding Research Principles and the Scientific Method and PT 603: Research Design. The student will form a faculty research committee, finalize the purpose statement, formulate the hypothesis, design a plan to carry out the research, outline the methods portion, obtain Institutional Review Board approval and identify appropriate statistical procedures to use in data analysis. In addition, the student will begin to execute the research project under the guidance of a research committee. This seminar meets individually and as a class with presentations and other seminar learning experiences provided throughout the semester.

PT 605 Research Seminar II (Besser)

Credits 3

Provides the student with the mechanisms to complete the final portion of the research project. With the guidance of their research committee, the student will complete data collection, analyze the data, write the manuscript, prepare a professional slide presentation and present his/her findings at a formal research day. The manuscript will be in a format suitable for submission to a peer-reviewed journal.

PT 690 Clinical Affiliation III (Rinehart Ayres)

Credits 4 and

PT 692 Clinical Affiliation IV (Rinehart Ayres)

Credits 4

Two eight-week affiliations in a variety of clinical settings. Students apply knowledge and skill gained through their past clinical and academic coursework and gain the proficiency needed to become an entry-level physical therapist.

PT 699 Research Project or Elective Independent Study (Rinehart Ayres, Besser, Bruckner, Dacko, Howard, Mount, Nelson)

Credits Maximum of 6

Graduate Center (GC)
Interdisciplinary Courses

GC 510 Database Design and Management (Waldman, Leone)

Credits 2
Summer

This applied, "how to" course lays the groundwork for an object-oriented approach to relational database development. The approach focuses on identification, formalization, and verification of study data. Students will learn how to collect and organize information into well-developed objects and relationships. Students will have the opportunity to perform statistical analyses on several real data sets using general-purpose statistical software packages. The course will also introduce students to Epi Info®, a public domain epidemiologic database and analysis application.

GC 515 Quality Measure/Outcomes Analysis in Health Care (Nash, Goldfarb)

Credits 3
Fall

The course will cover methods for quality measurement and improvement, application of these methods in various settings and populations, and current and future directions in quality. Student will develop an understanding of issues in defining and measuring quality of care in a variety of health care settings, and learn the skills to measure quality and analyze outcomes.

GC 525 Information Management (Bross)

Credits 3
Maximum number of students 15
Fall, Spring II

This course is designed to provide a detailed understanding of information systems and their use within the modern organization. It will explore the essential components of the systems and analyze how each is developed and linked into a production system. Contemporary computing concepts will be examined and a profile of strategic information management issues will be presented. Particular emphasis will be placed on the role of technology in assisting organizations to meet their operational and strategic goals. The course incorporates Internet activities, spreadsheets, and a database management package.

GC 526 Presentation Skills (Buescher, Scott)

Credits 2
Maximum number of students 16
Spring I

This course focuses on skills needed to make successful oral presentations, and poster presentations. Although no specific prerequisite courses are required, the nature of this course demands that students be at a point in their careers where they are prepared to make both an oral and poster presentation on a topic germane to their interests.

GC 529 Laboratory Animal Sciences (Jepsen)

Credits 2
Spring II

This course will introduce students to laboratory animal science. Topics will concern regulations and their effect on the care and use of laboratory animals, the biology, husbandry, and diseases of common laboratory animal species, ethical and scientific issues, experimental surgery and animal research techniques.

GC 535 Introduction to Genomics and Bioinformatics (Williams, Pellini)

Credits 2
Spring I

This course introduces the principles of medical genetics to graduate students who require a working knowledge of modern molecular genetics. The first half of the course will provide students with a background for understanding the genetics of disease. Topics to be reviewed will include: the chromosomal basis of heredity; the structure and function of genes and chromosomes; and the patterns of single and multifactorial inheritance. The second half of the course will acquaint students with the newly emerging fields of study as a result of sequencing projects (Bioinformatics, Proteomics and Pharmacogenomics) and explore the potential career opportunities in these areas. Several presentations will also be devoted to accessing DNA and protein analysis programs through the Internet, so that the student can gain hands-on experience navigating web-based information tools and extracting information from the growing number of databases available to biomedical researchers.

GC 600 Management Skills (G. Buescher, Arsenault)

Credits 3
Maximum number of students 25
Fall

This course introduces current theories and concepts of leadership and management and develops the skills necessary to successfully perform as a manager and leader. Based on input from focus groups with representatives from the pharmaceutical, biotechnology and healthcare industries, the course gives special emphasis to developing skills for collaboration, improved communication, problem solving, managing change, and reengineering.

GC 605 Performance Improvement (G. Buescher, Chatterton)

Credits 2
Maximum number of students 20
Fall

This course provides an introduction to the principles and concepts of Performance Improvement, (similar to the concepts of Total Quality Management, TQM). Emphasis will be on the importance of employee involvement and critical nature of customer focus. Material will demonstrate why performance improvement is so important in any industry and how these principles and concepts can be applied. It will provide an orientation to the analytical tools used in

performance improvement projects, and apply them to real work situations. Students will differentiate between the role of the project team and the role of line management. Class will discuss national quality awards and benchmarks.

GC 610 Strategic Management (Buescher, d'Arville)

Credits 3
Spring II

This course introduces the student to the Strategic Management Process as a base, to build on the basic management skills that the student has developed to date. The student will learn the nature and importance of planning; develop a "plan" for planning; relate planning to change management; and outline, investigate, and use the strategic management process. The student will learn to perform a situational audit, formulate program strategies and long and medium-range objectives, and learn the steps in strategic implementation.

GC 615 Grant Management (Grunwald)

Credits 2
Summer

This course is designed to serve as an introductory overview of the pre- and post-application procedures that relate to the writing, submission, review, award, and management of research grants. The areas included will be covered from both the perspective of the principal investigator as well as from the administrative viewpoint.

GC 620 Fundamentals of Financial Management (G. Buescher, Chatterton)

Credits 3
Maximum number of students 20
Spring I

The purpose of this course is to introduce the non-financial manager to financial systems, principles of accounting and their relationship to basic business activities. These concepts will be relevant to the research laboratory and discussion will center on basic financial statements and their analysis, financial planning, business language, and concepts, preparation and interpretation of financial statements. The use of electronic worksheets will also be incorporated in the analysis of case studies.

GC 621 Biotechnology and Venture Management (Saukkonen, Chou)

Credits 2
Summer

Students will be taught how to identify and analyze the factors that contribute to the creation of successful new business ventures. They will learn to consider the management problems associated with the founding of a new enterprise, either as a small business or as a part of an existing corporation. They will discuss the concepts and use the methodologies for putting together a successful business plan. Emphasis in the course will be on technology-based innovation.

GC 622 Cases in Financial Management (Buescher, Chatterton)

Credits 2
Prerequisite: GC 620 or permission of instructor
Maximum number of students 8
Fall

The course is designed to provide a Case Study approach for the implementation skills learned in GC 620. Students will work as Department Managers in a health care or academic "case" organization reviewing monthly financials, recommending actions based on their review, and preparing an annual budget. Students will complete a formal budget presentation and "defense" and attend mock meetings of Department heads with the instructor acting as CEO or CFO of the organization.

GC 625 Drug Development Issues (Gross)

Credits 2
Summer

This course explores the drug development process primarily at steps post-basic research. The course will examine the domestic and international regulatory environment, current requirements, and new drivers in the development process, specifically outcomes research and pharmacoeconomics.

GC 630 Fundamentals of Clinical Trials (Hauck)

Credits 3
Minimum number of students 12
Maximum number of students 20
Fall

This course introduces students to the fundamentals of clinical trials, from choosing a question and writing a protocol, through running a trial, to analyzing and reporting results. Key topics include how to assure validity in trials, what to include in a protocol, quality assurance of ongoing trials, statistical methods for analyzing trials, and how to review critically the reports of trials.

GC 635 Fundamentals of Clinical Trial Management (Saukkonen, Lata)

Credits 2
Spring I

This course introduces key principles and practical applications for the development of new pharmaceutical compounds. It will 1) introduce the student to the total clinical research process from the perspective of the current Good Laboratory Practices (GLP) and the current Good Clinical Practices (GCP), including specific global regulatory guidelines frame-working the development and approval of new pharmaceuticals; 2) focus on the responsibilities and effective interactions between the investigating research site and the various regulatory entities charged with ensuring the protection of the human research subject as well as the overall integrity of the clinical trial and the sponsor; 3) ensure that the student will be able to relate "real world" experiences and techniques to regulatory requirements, necessary to effectively prepare for and conduct a variety of clinical trials from the perspective of the investigator and sponsor.

GC 640 Research Ethics: The Responsible Conduct of Research (Flynn)

Credits 1
Maximum number of students 25
Fall, Spring I, Spring II

This graduate seminar course is designed to familiarize students with the ethical dilemmas inherent to the conduct of research. Topics to be discussed include codes of ethical behavior, research design, conflicts of interest, informed consent and the appropriate use of animals. The student will be required to prepare a paper on the analysis of one or more case studies.

GC 650 Pharmacoeconomics (Nash, Lofland)

Credits 3
Spring I

This course provides a thorough introduction to the field of pharmacoeconomics and disease management. Beginning with the basics such as reasons for study, the challenges facing experts, and the significance of the science, the course will propel students through the practical knowledge necessary to embark on current, valid, comprehensive studies. Cost benefit, cost utility, cost effectiveness methods will be defined in detail. Accounting and finance will be integrated with statistics and database skills. Students will learn how to use available technology to their advantage and will gain hands-on experience by conducting case studies of their own. In addition, the course includes a general introduction to managed care, including all relevant terminology, government institutions, current public policy, and varying viewpoints of experts in the field.

GC 655 Clinical Epidemiology (Waldman, Weinberg)

Credits 2
Prerequisite: MI 580 or permission of the instructor
Fall

The goal of this course is to introduce how basic epidemiologic and biostatistical techniques, useful in describing the determinants of disease in a population, can be used to answer specific clinical questions. Topics to be considered include issues of study design, cost-effectiveness and critical appraisal of the literature.

GC 660* Statistical Methods for Data Analysis (Diamond)

Credits 2
Maximum number of students 50
Fall

Students learn to apply the principles and techniques of basic statistical analysis. Lectures and workshop sessions will be used to familiarize the students with issues relating to both descriptive and inferential statistical methods. Students will have an opportunity to use a computer package for analysis.

GC 670 Experimental Design in Research (Diamond)

Credits 2
Prerequisite: GC 660 or permission of instructor
Spring II

The purpose of this course is to have students apply the principles and techniques of basic statistical analysis specifically to development of clinical research protocols. Lecture and workshop sessions will be used to gain an in-depth understanding of the issues relating to experimental design and conduct.

GC 680 Laboratory Techniques in Molecular Biology (Buescher, Kuo)

Credits 2
Maximum number of students 16
Fall, Spring II

The purpose of the course is to introduce the students to basic techniques in molecular biology, including genetic engineering. Beginning with an introduction to the biological significance of DNA and the fundamentals of good laboratory practices, students will become familiar with: purification and characterization of nucleic acids; cloning vectors, enzymes used in DNA cloning, and *E. coli* host strains; principles of restriction mapping, recombinant library construction, and the polymerase chain reaction; production and use of nucleic acid probes in hybridization to filter-immobilized DNA. Students will be instructed in the biochemical and biological concepts involved in the selected molecular biology techniques so that, at the completion of the course, students will have the ability to work through technical problems in this "kit-oriented" era, and to assimilate new techniques as they arise.

GC 700 Introduction to Neuroscience (Grunwald, Horn)

Credits 3
Fall

Introduction to Neuroscience is a graduate lecture/seminar survey course which is designed to introduce students to basic concepts and experimental approaches to issues in the neurosciences. The course is divided into two integrated sections focusing on 1) Neurophysiology and Synaptic Transmission and 2) Neuroanatomy and Systems. An interdepartmental team of faculty will lead students through these topics with a series of lectures and discussions based upon assigned text readings and current journal articles.

GC 720 Scientific Writing (Buescher, Dohm)

Credits 2
Summer

This course concentrates on the process of writing the dissertation / thesis or research paper and on the effective presentation of scientific information. Students will learn to write the sections of a research paper or thesis and will develop skills with various pieces of productivity software such as word processors, spreadsheets and statistical packages. Students will learn how to create sophisticated documents to improve communication of scientific information. The course emphasizes a reader-oriented approach to writing, critical analysis of good biomedical writing, and strong presentation of data and ideas. Some time will also be spent on principles of effective oral presentations.

Interdepartmental Courses (ID)

ID 501 Pharmacology in Rehabilitation (Lyons)

Credits 3

Provides an overview of the major classes of drugs with an emphasis on their mechanisms of action, rationale underlying therapeutic uses, adverse reactions and drug interactions. This overview is supplemented by written assignments in students' areas of interest.

ID 512 Current Topics in Healthcare Law (Lyons)

Credits 3

Examines in-depth the problems or issues of current concern in healthcare law. Emphasizes recent contributions to theory and practice. Introduces the student to working concepts of the legal process in America and to particular techniques of its implementation. Explores the ways in which the legal system utilized the expertise of clinicians, laboratory and other scientists, and public health professions to seek justice as well as truth.

ID 513 Managing People (Lyons)

Credits 3

Explores supervisory issues in the health care setting for health care professionals who are either in new (less than two years) supervisory positions or expect to be in the immediate future. Investigates several theories of supervision and provides a full range of skill development in the supervisory domain: problem solving, conflict management, leadership, group process, and interpersonal relations.

ID 514 Organization Development (Lyons)

Credits 3

Presents a social-psychological perspective to the study of organizations. Focuses on understanding ways in which organizations can be made more effective through the process of organization development. Relates closely to the process of growth and change in organizations. Concentrates on three major areas: strategies of organizational change, organization development as an independent concept, and specific skills needed by organization development consultants. Identifies various strategies which have been found effective in producing change, understanding the multidimensional nature of organizations, investigating the research on organization development, and applying the strategies and research to a practical situation. Addresses questions of formal and informal power in organizations.

ID 515 Neurobiology and Endocrinology (Lyons)

Credits 3

Advances the student's knowledge of the functional organization of the nervous system and the physiological mechanisms by which the nervous system promotes individual survival. Includes such topics as how sensory information is perceived and transmitted, pattern recognition and central processing of information, learning and memory, and how behavior is generated and organized. Combines this information with basic neurochemistry and neuropharmacology and applies it to an understanding of selected neurological disorders.

ID 517 Introduction to Pharmacology (Pendelton)

Credits 3

Presents an overview and synthesis of the basic mechanisms of drug action and the way in which drugs interact with biological tissue. Emphasizes drug receptors, agonists and antagonists and the predictability of many drug actions and side effects. Covers areas such as: routes of administration, absorption, distribution and elimination, receptor theory, the nervous system, and each major class of drugs.

ID 518 Health Care Issues: Quality and Cost (Nash)

Credits 1

In this seminar format class, we will define quality of care as it pertains to health care practice today; explore the relationship of quality to cost containment; and discuss current issues pertaining to quality of care including TQL, TQM, how quality is assessed, and quality from a patient's perspective.

ID 520 Issues in Physiology (Rosenfeld)

Credits 3

Discusses current issues in physiology involving the major organ systems. Explores these issues in depth at the metabolic, cellular and systemic levels. Integrates the knowledge and material at these different levels. Enables the student to better appreciate the field of physiology while preparing the individual for further study.

ID 521 Adult Development: Continuity and Change (Lyons)

Credits 3
Prerequisite: Psychology 323 (CHP), or equivalent

Explores the nature of adult development as influenced by external factors such as work, family, and social systems, as well as internal factors like personality, identity, and defense mechanisms.

ID 522 Marketing Health Care Services and Programs (Lyons)

Credits 3

Provides an overview of marketing techniques, including marketing research, market research data to make strategic decisions, and marketing communications. Provides students with an opportunity to apply these ideas to today's health care environment through case studies and projects.

ID 523 Cardiac/Renal Physiology (Lyons)

Credits 3

Gives a detailed description of the physiological and biophysical processes that regulate cardiovascular and renal function and develops an understanding of the interrelationship between these two organ systems in health and disease. Emphasizes structure as relating to function, electrophysiology, muscle mechanics, blood rheology, countercurrent theory, and cellular transport. Employs journal articles to emphasize research in special areas of cardiorenal physiology.

ID 524 Psychosocial Aspects of Disability (Lyons)

Credits 3

Pursues a study of relevant psychological, social, and behavioral concepts as they apply to allied health professionals. Emphasizes the importance of the effect of patient motivation, social support systems and psychosocial developmental needs in the rehabilitation process of disabled people. Discusses the role of the helping person in this process, particularly with regard to value and authority/power dynamics.

ID 526 Accounting and Finance for Managers (Lyons)

Credits 3

Introduces the subjects of accounting and finance in the health care industry. Covers basic concepts of accounting and finance with focus on practical application. Exposes students to a wide variety of financial professionals.

ID 527 Statistics, Epidemiology and Inference In the Health Sciences (Lyons)

Credits 3
Prerequisite: Math 401 (CHP) or equivalent

Presents fundamental concepts and methods of biostatistics and epidemiology. Emphasizes understanding implications of various analytic approaches and their impact on decision-making and inference in the health sciences. Includes research design; concepts of probability, risk and sampling; measures of disease impact; screening procedures; analysis of treatment effects; and factors affecting the distribution of disease.

ID 540 Launching New Ventures: An Entrepreneurial Approach (Lyons)

Credits 3

Approaches the process of launching a new venture from a wholly practical standpoint. It starts from the premise that successful businesses are built before they ever open their doors. Students learn how to recognize and take advantage of opportunities as a new century approaches. The course facilitates the pre-venture planning process through such mechanisms as feasibility plans, business plans, marketing plans, operational plans, incorporation checklists, and new product checklists.

ID 550 Care of the Elderly: An Interdisciplinary Approach (Lyons)

Credits 3

Students will develop a personal model for organizing services for the elderly using a team approach and person-environmental theories. Comprehensive services for individuals and their caregivers will be designed using formal and informal social systems. Students will be required to fieldtest their model.

ID 560 Advanced Pharmacotherapeutics (Lyons)

Credits 3

Examines selected topics in contemporary pharmacotherapeutics, such as hypertension, diabetes, infectious diseases and women's health issues. It enables the student to select appropriate drug therapy for a patient presented with one of the selected disease states and develop a monitoring and outcome pharmacotherapeutic plan for the patient. Emphasizes the learning of rational decision-making skills in selecting drug therapy for patients of various social, economic, and cultural backgrounds.

ID 570 Financial Management of Healthcare Organizations (Lyons)

Credits 3
Prerequisites: ID 514, ID 526

Examines the financial environment of healthcare institutions including sources of revenue such as Blue Cross/Blue Shield, Medicare/Medicaid, and Health Maintenance Organizations. It examines alternate methods of financial capital investment in conjunction with capital expenditure controls.

ID 580 Providing Community Consultation in Health Care (Lyons)

Credits 3
Prerequisite: Permission of the Instructor

Teaches health care providers how to structure and deliver health services as a consultant in the community. Exposes students to different consultation models and explores how each model shapes professional behavior and focus. Introduces health intervention techniques and provides students with opportunities to observe and practice these techniques, both in the classroom and on-site in community locations.

ID 585 Interdisciplinary Team-based Health Service for Underserved Populations I (Lyons)

Credits 3

Provides information and experiences that will meet both cognitive and affective learning objectives related to working as part of an interdisciplinary team providing community-based service to an underserved population. Assists students in: a) developing team building skills; b) integrating discipline-specific knowledge into an interdisciplinary framework; c) expanding key concepts on the biological, psychological, and social aspects of underserved populations; and d) participating in interdisciplinary community-oriented services, including health promotion and restoration for individuals who are homeless.

ID 586 Interdisciplinary Team-based Health Service for Underserved Populations II (Lyons)

Credits 3

Continuation of Interdisciplinary Team-based Health Service for Underserved Populations I. It is designed to provide ongoing information and experiences that will meet both cognitive and affective learning objectives related to working as part of an interdisciplinary team providing community-based service to an underserved population. The didactic experiences will assist students in: a) improving and refining team skills through ongoing evaluation; b) implementing and evaluating interdisciplinary team-based health care; c) generalizing strategies of health care for individuals who are homeless to other underserved populations; and d) understanding the linkages among theory-based practice, research, and health policy in the development and delivery of community-based health care to underserved populations. The practicum component will provide students with the opportunity to: a) function as members of an interdisciplinary health care team; b) participate in case management and consultation; c) implement and test interdisciplinary team-based strategies of health care; and d) design solutions to current legal, ethical, or public policy issues regarding care of individuals who are homeless, and discuss these solutions with service providers and health policy makers.

ID 589 Human Services Techniques (Lyons)

Credits 3

Advances essential to interpersonal skills for helping people with emotional, developmental, social, or physical problems, both inside and outside the organized human service delivery system. Discusses how these skills can be applied to a wide variety of therapeutic, supportive, and preventive settings. Covers, but is not limited to, skills training in interviewing, counseling, stress management, and group work. Enables health professionals from all specialties to learn about themselves and how they relate to others.

ID 590 Family Systems and Health Care: A Multicultural Perspective (Lyons)

Credits 3

Identifies a family-centered approach to the psychosocial needs of families dealing with a range of chronic and life-threatening health problems in children and adults. Examines families from a multicultural perspective as they move through a variety of contexts. Challenges and guides the student health clinician's own beliefs and assumptions to promote healthy family functioning.

ID 595 Ethics and Scientific Method (Lyons)

Credits 3

Examines the ethical character of scientific medicine. Explores the ethical values and visions of medical researchers, and studies how their racial, social, and scientific prejudices led them (or can lead them) to design their experiments and work through their research.

ID 627 Approaches to Management and Supervision (Lyons)

Credits 3

Explores strategies for effective supervision including personal and group communication skills, program development, strategic planning, problem-solving and staff evaluation, coaching, supervision and discipline. Uses the adult learning continuum, enabling students to analyze their own learning and supervisory style, develop a program change strategy, deal with and resolve conflict, empower staff members to participate in department management, and effect change in a specific program.

ID 699 Independent Study (Lyons)

Credits 1-6

Index of Graduate Faculty by Department, with Program Affiliations in Parentheses

Abraham, David, B.S., M.S., Ph.D., *Professor of Microbiology and Immunology* (GE, IM, MI)

Akins, Robert E., Jr., Ph.D., *Assistant Research Scientist (TE)*

Allen, Arthur, B.A., M.A., Ph.D., *Professor of Biochemistry and Molecular Pharmacology* (BI, PR)

Alnemri, Emad S., B.S., M.S., Ph.D., *Professor of Microbiology and Immunology* (GE, PR)

Ayres, Margaret Rinehart, Ph.D., *Associate Professor of Physical Therapy* (PT)

Balachandran, Indra, Ph.D., *Assistant Professor of Laboratory Sciences* (LS)

Barone, Frank, Ph.D., *Adjunct Assistant Professor of Biochemistry and Molecular Pharmacology* (BI)

Baserga, Renato, M.D., *Professor of Microbiology and Immunology and Deputy Director of the Kimmel Cancer Center* (GE)

Bear, Susan E., Ph.D., *Instructor of Microbiology and Immunology* (MI)

Beck, Carol, Ph.D., *Assistant Professor of Biochemistry and Molecular Pharmacology* (BI)

Behrendt, Thomas, M.D., *Professor of Ophthalmology and Clinical Associate Professor of Family Medicine*

Belcher, Anne E., Ph.D., *Professor of Nursing* (NU)

Benovic, Jeffrey L., B.S., Ph.D., *Professor and Vice Chairman of Microbiology and Immunology* (BI, GE, PR)

Berd, David A., B.S., M.D., *Professor of Medicine* (IM)

Besser, Marcus P., B.S., M.S., Ph.D., *Associate Professor of Physical Therapy, Acting Chair of the Department* (PT)

Bianchi, C. Paul, B.A., M.S., Ph.D., *Emeritus Professor of Biochemistry and Molecular Pharmacology* (BI, PR)

Birk, David E., Ph.D., *Professor of Pathology, Anatomy and Cell Biology* (DB, TE)

Biswas, Esther E., Ph.D., *Assistant Professor of Laboratory Sciences* (LS)

Block, Timothy M., B.A., Ph.D., *Professor of Biochemistry and Molecular Pharmacology and Professor of Medicine* (BI, GE, MI)

Boman, Bruce M., B.A., M.S., M.D., Ph.D., *Professor of Medicine* (GE)

Borer, William Z., B.S., M.S., M.D., *Clinical Professor of Pathology, Anatomy & Cell Biology and Director, Clinical Chemistry and Toxicology* (PA)

Bowen, Mary M., R.N., B.S.N., M.S.N., D.N.S., *Assistant Professor of Nursing* (NU)

Brainard, George C., B.A., M.A., Ph.D., *Professor of Neurology and Professor of Biochemistry and Molecular Pharmacology* (BI, PR, TE)

Brenner, Charles, B.A., Ph.D., *Associate Professor of Microbiology and Immunology* (GE, PR)

Bruckner, Janice S., Ph.D., *Associate Professor of Physical Therapy* (PT)

Buchberg, Arthur M., B.Sc., Ph.D., *Associate Professor of Microbiology and Immunology* (GE, IM, MI)

Buescher, Georganne K., B.S., M.S., Ed.D, *Clinical Assistant Professor of Microbiology and Immunology and Associate Dean, College of Graduate Studies* (MI)

Buescher, Jerome G., B.A., Ph.D., *Adjunct Clinical Assistant Professor of Microbiology and Immunology*

Burke, Janice P., M.A., Ph.D., OTR/L, *Associate Professor and Chair, Occupational Therapy* (OT)

Butler, Thomas Michael, B.A., Ph.D., *Professor of Physiology* (PS)

Calabretta, Bruno, B.S., M.D., Ph.D., *Professor of Microbiology and Immunology* (GE, IM)

Calkins, Catherine E., B.A., Ph.D., *Professor of Microbiology and Immunology* (IM)

Campbell, Philippa H., B.A., M.Ed., Ph.D., *Professor of Occupational Therapy* (OT)

Caro, Jaime, M.D., *Professor of Medicine and Physiology* (PS)

Chepenik, Kenneth P., B.S., M.S., Ph.D., *Professor of Pathology, Anatomy & Cell Biology* (PA)

Chu, Mon-Li H., B.S., Ph.D., *Professor of Biochemistry and Molecular Pharmacology and Professor of Dermatology* (BI, TE)

Cohen, Michelle E., B.A., M.Ed., Ph.D., *Assistant Adjunct Professor of Rehabilitation Medicine and Adjunct Assistant Professor of Occupational Therapy and Physical Therapy* (OT, PT)

Conn, Rex B., B.S., B.Sc., M.S., M.D., *Professor of Pathology, Anatomy & Cell Biology, Emeritus; Vice Chairman for Hospital Services and Director, Clinical Laboratories*

Coss, Ronald A., B.A., Ph.D., *Professor of Radiation Oncology and Professor of Pathology, Anatomy & Cell Biology* (DB, PA)

Covarrubias, Manuel L., M.Sc., M.D., Ph.D., *Associate Professor of Pathology, Anatomy & Cell Biology* (DB, PA)

Croce, Carlo M., M.D., *Professor and Chairman of the Department of Microbiology and Immunology and Director of the Kimmel Cancer Institute and Kimmel Cancer Center* (GE, IM, MI)

Curtis, Peter, B.Sc., Ph.D., *Professor of Microbiology and Immunology* (GE)

Dacko, Stan, Ph.D., *Assistant Professor of Physical Therapy* (PT)

Darby, Martyn K., B.Sc., Ph.D., *Assistant Professor of Microbiology and Immunology* (BI, GE)

Davidson, Edgar, B.S., Ph.D., *Research Assistant Professor of Biochemistry and Molecular Pharmacology* (BI)

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During, Matthew, Ph.D., *Professor of Neurosurgery* (GE)

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Grebner, Eugene E., A.B., M.S., Ph.D., *Honorary Research Associate Professor of Medicine*
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Gulati, Gene L., B.Sc., M.S., Ph.D., *Clinical Associate Professor of Pathology, Anatomy & Cell Biology and Associate Director of Hematology Laboratory* (PA)
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Hare, Theodore A., B.S., Ph.D., *Professor of Biochemistry and Molecular Pharmacology* (BI, PR)
Harrison, Robert W., B.S., Ph.D., *Assistant Professor of Microbiology and Immunology* (PR, TE)
Hauck, Walter W., B.S., M.A., Ph.D., *Professor of Medicine, Division of Clinical Pharmacology, Department of Medicine*
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Johnson, Erica S., Ph.D., *Assistant Professor of Biochemistry and Molecular Pharmacology* (BI)

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University Policies

I. Student Rights, Freedoms, and Responsibilities

'Student Rights, Freedoms, and Responsibilities' originally approved by the Board of Trustees on February 2, 1970, was revised by an *ad hoc* committee during 1994-1996. Following ratification by the majority of the student body, this document was approved by the Board of Trustees, as amended, on May 6, 1996.

General Statement

Thomas Jefferson University is a not-for-profit academic health center which exists: to provide excellent educational programs and experiences for future health care professionals; to contribute substantially to the research, development, and introduction of improved methods of health care; and to provide high quality health care in a cost-effective manner. For the University to function as a harmonious unit, certain guidelines must be established by which the interactions of individuals within the University may be coordinated. This document outlines the rights, freedoms, and responsibilities of all students matriculating at Thomas Jefferson University.

Preamble

In addition to those rights and responsibilities ensured by the Constitution of the United States and those limitations imposed by federal, state, and local laws, are special rights and responsibilities acquired by students because they are members of the University community. Besides clarifying these special rights and responsibilities, this document enumerates the means by which abuse of these rights and responsibilities will be treated by the University.

I Academic Freedom

Because intellectual development is best fostered in an atmosphere of active engagement in the educational process, each faculty member should encourage free discussion, free inquiry, and free expression regarding issues within the domain of the instructor's course or program. Students are free to take reasoned exception to the data or to views offered in any course of study and to reserve judgment about matters of opinion.

II Evaluation

A. Students are evaluated on the basis of:
   1. their academic and clinical performance,
   2. adherence to professional standards, and
   3. compliance with standards of student conduct articulated by the college in which the course was taken.

B. The use of information unrelated to the standards of Evaluation is inappropriate. Students may appeal an evaluation that they allege is not based on these criteria. The appeal should take place through the appeal process of that college.

C. A faculty member should excuse himself or herself from evaluating a student if the faculty member believes that he or she cannot make an objective evaluation as a result of his or her possession of information unrelated to the standards of Evaluation.

III Protection Against Improper Disclosure

Ordinarily information obtained from students in the course of counseling, teaching, or advisory meetings shall be treated as confidential. Under certain circumstances it may not be possible to maintain confidentiality of such information. Such circumstances include, but are not limited to, situations where a student's communication indicates potential harm to the student or to another party, or where maintaining the confidentiality would prevent a faculty member from fulfilling his or her responsibility to protect society and the reputation and integrity of the institution. In such situations the faculty member or advisor has the obligation to take appropriate follow-up action, safeguarding, to the extent possible, the confidential nature of the information. In instances of doctor-patient, religious, or other privileged interactions, the guidelines controlling those special situations pertain.

IV Student Records

Thomas Jefferson University complies with The Family Education Rights and Privacy Act (FERPA) in its maintenance of student records. Each college's policy statement on FERPA is on file and available in the registrar's office of the college.

V Student Organizations

A. Students are free to organize and join associations that promote their common interests. Organizations that operate in a manner consistent with the University's mission, regulations, and policies, including its non-discrimination policies and meet the requirements below may be recognized by the University. If recognized, such organizations may seek funding from University sources. The requirements for recognition are:

1. The membership, policies, and actions of a student organization shall be developed only by vote of those persons who are matriculated students of Thomas Jefferson University.

2. Each student organization that seeks recognition by the University is required to submit to the Office of Student Affairs and/or the appropriate oversight body of its college complete bylaws, a statement of purpose, criteria for membership, rules of procedure, a current list of officers and members, and the name of a designated faculty or administrative staff advisor. Any changes in the preceding *modus operandi,* or advisor must be submitted to the college's Office of Student Affairs within two weeks of the change. Such organizations must annually re-submit for recognition and/or funding.

3. The advisor shall be chosen with his or her consent. Advisors will advise organizations about University policies and procedures. However, the advisor does not have the authority to control the policy of such organizations.

4. Recognized organizations must refrain from:

    a) using the organization for the financial enrichment of any officer, member, or affiliate of the student organization

    b) directly or indirectly using University resources for the express benefit of external affiliates

    c) maintaining outside bank accounts (Accounting for such organizations will be through the TJU controller's office or the Commons Board.)

    d) using the name of the University or any of its divisions on private bank accounts

    e) entering or attempting to enter into contractual obligations on behalf of the University or any of its divisions or departments without prior written authorization from the appropriate University senior officer or his or her designee. The organization's advisor may not give such consent.

    f) soliciting funds outside of the University without the written approval by the student affairs office of the appropriate college

    g) representing or implying that the organization acts as an agent of, or with the authority of, the University.

B. A campus student organization may be affiliated with a parent or corresponding extramural organization, but the campus student organization must:

    1. disclose to the University oversight body such extramural affiliations

    2. provide the constitution and bylaws of any affiliated organization and

    3. certify that all conditions for affiliation meet the standards of the University

C. A student who misrepresents his/her own or a group's relationship with the University or violates any of his/her college's or the University's rules shall be subject to the sanctions described in the section on Discipline (section XII) in this document.

D. Students' groups that are not recognized by the University

    1. may not represent themselves as affiliated with the University or any of its parts

    2. may not receive funds from the University

    3. may use University facilities only if they meet the requirements for use of University facilities by outside parties and meet the requirements stated in section V. A. 4.

VI Freedom of Inquiry and Expression

A. Students and student organizations may discuss all questions of interest to them; may express their opinions privately and publicly, so long as they make it clear that they speak only for themselves and not for

the University or their college; and may support causes so long as these activities do not violate civil law or rules, policies and procedures of Thomas Jefferson University or their college, or adversely affect the operations of the University.

B. The right of free speech and expression does not include activity that may endanger the safety of any member of this University community or damage any of the University community's physical facilities, nor does it include any activity that disrupts or obstructs the functions of the University or threatens such disruption or obstruction. Moreover, modes of expression, including, but not limited to, electronic transmissions, that are unlawful or indecent or that are grossly offensive on matters such as race, color, national and ethnic origin, religion, sexual orientation, sex, age, disability, or veteran status are inconsistent with accepted norms of conduct of the University and are subject to the sanctions described in the section on Discipline (section XII).

C. Recognized student organizations may invite speakers on campus as long as the organization

   1. provides adequate advance written notice to the pertinent office of student affairs and received written approval from the same office
   2. bears the cost of any additional services deemed necessary by the inviting organization and/or by the office of student affairs
   3. follows institutional procedures
   4. ensures a decorum appropriate to an academic community
   5. states in all promotional literature and activities that its sponsorship of guest speakers does not imply approval or endorsement of the speaker's views by the University.

VII Student Publications

A. Publications of recognized student organizations.

   Publications that are written or distributed by organizations that are recognized or financed in any way by the University have editorial freedom, but shall be subject to the canons of responsible journalism and review by the organization's advisor. These canons include, but are not limited to, the prohibition of undocumented allegations, the avoidance of libel, respect for the good name of individuals and the University, the requirements of civil law, and University policies and procedures. The University retains the right to impose discipline for good cause on the managers, editors, and writers of student publications.

B. Publications of unrecognized student organizations.

   1. The publications of student organizations that are financially independent and not recognized by any University oversight may not represent themselves as affiliated with the University or any part of the University and may not use the name of the University or any of its parts in the group's communications without prior written authorization by the office of student affairs of the appropriate college.

2. The University views the publications of unrecognized organizations as the product of a group of students who are individually responsible for their own actions and those of the unrecognized group.

C. Distribution of handbills, posters, pamphlets, or other written material.

1. Posters and other similar written notices must be registered with the appropriate college's office of student affairs. Such notices may be put only in locations designated for that purpose by the office of student affairs.

2. Handbills and pamphlets that in any way invoke the name of the University or any of its parts must clearly display the following disclaimer: "Not endorsed by Thomas Jefferson University." University recognized organizations may distribute materials meeting the preceding guidelines, but only in public areas. Distribution in classrooms or offices is prohibited. Organizations that are not formally recognized by the University may not distribute such materials anywhere on Jefferson property or at any Jefferson event without prior written permission from the appropriate office of student affairs.

3. The location of indoor distribution of written material may be restricted to preserve safety, security, and the orderly conduct of scheduled events.

VIII Student Participation in Institutional Government

As constituents of Thomas Jefferson University, students are encouraged to express their views, through established channels, on issues of institutional policy and on matters of general interest to the student body. Further, by means of active membership on faculty and administrative committees, the student body participates in the formulation and application of institutional policy as it affects academic and student affairs.

IX Off-Campus Activities

It is the policy of Thomas Jefferson University to comply with all federal, state, and local laws and regulations. The University will not shield from action by civil authorities any employee, student, or faculty member involved in an illegal activity. Furthermore, as stated in the University's *Search Policy* (Policy 119.01), the University reserves the right to investigate any campus facilities or personal belongings if it has information to support a reasonable belief that an illicit activity is occurring.

X Standards of Conduct

A. Students enrolled at Thomas Jefferson University are required to follow a code of behavior consonant with the high standards of the medical and health sciences professions and the reputation of the University. Standards of professional behavior include honesty, integrity, civility, and, where possible, assistance to one's colleagues with problems or in distress. In addition, students shall comply with all rules and regulations duly established within their respective colleges.

B. Misconduct includes, but is not limited to:

1. Dishonesty, such as cheating, committing plagiarism, knowingly furnishing false information, or engaging in unethical conduct in research.
2. Forgery, alteration, or misuse of documents, records, or identification that are pertinent to the student's role at the University.
3. Abuse, malicious misuse, damage, or destruction of University property.
4. Abuse of, assault and battery upon, or threat of force or violence against any member of the University community.
5. Theft or misappropriation of, or damage to, any property either temporarily or permanently located on campus.
6. Commission and subsequent conviction of any felony or misdemeanor.
7. Obstruction or disruption of teaching, research, administration, disciplinary procedures, or any other authorized activities of the University on campus, or creation of an unreasonable risk of harm to any member of the University community (premises owned or controlled by Jefferson or premises on which students pursue activities in their roles as students of the University).
8. Unauthorized entry into, occupation of, or obstruction of any building, structure, or part thereof at any time and anywhere on campus.
9. Falsification of or failure to provide personal identification when requested by an authorized official or by a faculty member of the University when such request is consistent with the rules and regulations of the institution.
10. Violation of any other duly established rules and regulations of the University.

XI Investigation of Misconduct

A. Where appropriate, the University shall investigate allegations of misconduct, as defined above. Such investigations may be performed by appropriate administration authorities, including, but not limited to, the Office of Student Affairs, Security, and the respective college deans or their designees.

B. Where an allegation of misconduct gives authorities reasonable cause to believe that a search is needed, the search will be performed in accordance with the Jefferson Search Policy (Policy 119.01).

C. The University may conduct other forms of investigation as needed, before the matter is referred for discipline.

XII Discipline

The degrees of discipline include, but are not limited to: reprimand, disciplinary probation, suspension, and dismissal. Suspension and dismissal are prerogatives of the Dean of the student's college upon the recommendation of the Judicial Board of the College.

The discipline process described in this document is separate from other mechanisms (e.g., the Student Code of Professional Conduct Committee of Jefferson Medical College) charged to consider allegations of inappropriate conduct in the respective colleges. In the event of a conflict between such a mechanism to review professional conduct and the Judicial Board, the Judicial Board's decisions shall have precedence.

Reprimand. Reprimand is a written or verbal admonition to a student for improper behavior that constitutes a minor offense. It may be issued by an administrator or by any member of the faculty of the college in which the student is enrolled, or by the college's Judicial Board. Written reprimands may be reported to the faculty advisor, the department or program chairman, and/or the office of the Dean, as appropriate. The dean, at his or her discretion, may or may not make a reprimand part of a student's permanent official record, and if so, shall notify the student, allowing the student to attach written comment.

Disciplinary Probation. A student may be placed on disciplinary probation by the dean upon recommendation by the judicial board for not longer than one academic year. During that time the student may remain on campus.

The judicial board shall determine the duration of said probation, the conditions governing it, and whether it will become part of the student's record.

Suspension. Suspension represents temporary separation from the University for misconduct. Suspension may be for a variable period of time and with certain conditions attached, but in no case shall it exceed one academic year in addition to the year in which the case is decided. Suspension may be invoked only by the Dean upon recommendation of the Judicial Board of the college in which the student in question is enrolled. During the procedures of the Judicial Board, the dean in his or her sole judgment may suspend a student if there is a risk of significant harm to University community or property.

Dismissal. Dismissal for misconduct from any one college in the University is mandatory exclusion from all colleges of the University. The dismissal may be permanent or with a right to re-apply for re-admission. Dismissal will be invoked only by the relevant college dean or dean's delegate following the recommendation of the college's judicial board. If the right of re-application has been allowed, the dean of the college will entertain the application for re-admission to the college. Under no circumstance shall the student be allowed to re-apply less than one year following dismissal. Pending the outcome of an appeal of the decision to dismiss, the student in question may be temporarily separated from the University by the dean of the college in which the student is enrolled.

XIII Judicial System

A. Judicial Boards on Student Conduct

1. *Definition.* Each college of Thomas Jefferson University shall have a standing faculty-student board designated as the Judicial Board to hear allegations of misconduct as defined in the document on Student Rights, Freedoms, and Responsibilities. Additional boards may be impaneled by the appropriate body as needed at the request of the Dean in situations she or he deems necessary to safeguard in a particular case the student's rights to a speedy resolution of an alleged infraction. Provision for overlap in the existing Boards shall be made if the infractions being heard are related in a material way.

2. *Board Membership.* Each board shall consist of

   a) a member of the administration designated by the dean of the respective college

   b) two faculty members and two alternates of such college

   c) two students and two alternates enrolled in such college

   The same process of appointment to the board shall be followed as that customarily followed for all faculty-student committees of the respective college or as provided in the bylaws of the college unless otherwise indicated. The Dean shall remain independent of the deliberations in order to preserve his or her later role in the appeal process.

3. *Quorum.* In all cases, a quorum of the board shall consist of all five members, or alternates in the same proportion as previously specified. All decisions of the board shall require a majority vote of the members present, except for dismissal or suspension, which requires an affirmative vote of at least four of those present.

B. *Board Procedure.* The board, by majority vote of the whole board, shall elect one of its members as chairman at the beginning of the academic year. The Board may also designate a secretary to record the discussion and prepare a summary of the proceedings. The chairman will be responsible for the conduct of the hearing. The summary must be approved by the Board and must be prepared for each session.

   The Board or the accused with the Board's concurrence may call any person whom it deems to possess relevant information concerning the matter before the Board.

C. *Conduct of Hearing.*

1. *Initiation of Hearing.* The hearing of an alleged offender shall be initiated by a written charge from the dean to the chairman of the Judicial Board. Ordinarily the initial hearing should take place within 15 business days of the receipt of the charge by the Board.

2. *Notice of Offense.* The chairman of the board, after consultation with the dean, shall give written notice of any alleged infraction of student conduct to the alleged offender at least five business days prior to the convening of the Board to hear such case. Such written notice shall consist of the following: a list of witnesses, the specific allegations, the basis for the charges, notice that he or she has the right to an advisor as described in Section C.3, and a Waiver form (see C.3, below). In addition, the alleged offender shall be given specific notice of the penalties that may be imposed.

3. *Representation at the Hearing.* In all cases the alleged offender shall have the right to have present an advisor of his or her own choosing. If the alleged offender desires to appear before the Board without legal counsel, he or she must submit to the chairman of the Board the signed Waiver of the right to counsel no later than 48 hours before the time of the hearing, stating that he or she does so with full knowledge and intent to do so. Under no circumstances is Thomas Jefferson University, or any of its Colleges, required to retain counsel on behalf of the alleged offender or pay the cost of any party producing information on behalf of the accused. Should counsel for the alleged offender be present, the chairman of the Board shall inform the counsel that her or his role is solely that of an advisor to his or her client.

4. *Appointment of Hearing Officer.* In any case, the Board shall have the right to appoint a Hearing Officer to conduct the examination of witnesses from among the faculty or staff of the respective college or any other person as it may deem appropriate.

5. *Board Review.* After the conclusion of the Hearing, the Board will meet to review all relevant facts and circumstances and reach a decision about appropriate action, if any.

D. *Disposition about the Board's Decision.* The decision of the Board shall be communicated to the Dean of the pertinent college by the chairman of the Judicial Board within seven (7) business days. The Dean, after due consideration of all relevant factors, will take one of the following actions within seven (7) business days:

- Accept the Board's decision and forward it to the student
- Mitigate the Board's decision in a manner he or she deems appropriate
- Refer the matter back to the Board for additional consideration

E. *Appeal.* The alleged offender may appeal the disposition of his or her case to the Dean within ten (10) business days following receipt of the action by the Dean. The appeal must be based on either a lack of due process or new information not available at the time of the hearing. Such requests shall be granted or denied at the discretion of the Dean within five (5) business days after its receipt based on an analysis of whether the new information is likely to make a significant and substantial difference in the initial disposition of the case or whether the due process provided to the student was consistent with University

procedures. Should the request be granted, a new hearing will be conducted as described in section XIII, paragraph C, unless the Board decides without a hearing to reduce or eliminate the sanction set forth in its initial decision. The final disposition of the appeal will be made known to the alleged offender in accordance with the time requirements set forth in paragraph D above.

F. *Appeal to President.* Each alleged offender shall have the right to a final appeal to the President of Thomas Jefferson University within fifteen (15) business days of the rendering of a final decision by the student's College. The President may consider claims by the student of arbitrary or capricious behavior, the appropriateness of the penalty, and the extent of due process afforded. Upon such appeal, the President may:

   1. affirm the decision of the College,
   2. require the College to reconsider the decision or rehear the case, or
   3. reduce the severity of the penalty imposed by the College process.

   All decisions of the President are final. In reaching his decision, the President may discuss the case with any witness, the alleged offender, or any participant of the College process.

XIV Amendment

This document of Student Rights, Freedoms and Responsibilities may be amended by:

A. PRESENTATION of a proposed amendment to a joint committee appointed by the President and composed of student, administrative, and faculty representatives from all colleges in the University. The presentation must originate from one or more of the following sources:

   1. any student interest group whose proposed amendment is endorsed by ten percent of a college's student body matriculated in a degree-granting program or
   2. any faculty group whose proposed amendment is endorsed by ten percent of a college's full-time, fully-salaried faculty or
   3. the dean of a college or
   4. the President of the University

   This joint committee will then determine if the proposed amendment is in accordance with the goals of the University and is in the best interest of the University, the faculties, and the student body as a whole. The joint committee shall be responsible for making available to the student body the minutes of its meetings. Acceptance by the committee requires two-thirds majority.

B. RATIFICATION BY majority vote of each of the three college's student representative bodies and the appropriate faculty bodies of all three colleges, as determined by the Deans of the respective colleges will be necessary before the proposed amendment can be presented to the Board of Trustees of the University for final approval.

XV Board Approval

All amendments to this document will become official only upon approval by the Board of Trustees. This document was approved by the Board of Trustees on February 2, 1970 and amended May 6, 1996.

II. The Family Educational Rights and Privacy Act

The Family Educational Rights and Privacy Act (FERPA) affords students certain rights with respect to their education records. They are:

1. The right to inspect and review the student's education records within 45 days of the day the University receives a request for access.

Students should submit to the Associate University Registrar written requests that identify the record(s) they wish to inspect. The University Office of the Registrar will make arrangements for access and notify the student of the time and place where the records may be inspected. If the records are not maintained by the University official to whom the request was submitted, that official shall advise the student of the correct official to whom the request should be addressed.

2. The right to request the amendment of the student's education records that the student believes are inaccurate or misleading.

Students may ask the University to amend a record that they believe is inaccurate or misleading. They should write to the University official responsible for the record, clearly identify the part of the record they want changed, and specify why it is inaccurate or misleading. If the University decides not to amend the record as requested by the student, the University will notify the student of the decision and advise the student of his or her right to a hearing regarding the request for amendment. Additional information regarding the hearing procedures will be provided to the student when notified of the right to a hearing.

3. The right to consent to disclosures of personally identifiable information contained in the student's education records, except to the extent that FERPA authorizes disclosure without consent.

One exception that permits disclosure without consent is disclosure to school officials with legitimate educational interests. A school official is a person employed by the University in an administrative, supervisory, academic or research, or support staff position (including law enforcement unit personnel and health staff); a person or company with whom the University has contracted (such as an attorney, auditor, or collection agent); a person serving on the Board of Trustees; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting another school official in performing his or her tasks.

A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibility.

The University, at its discretion, may provide directory information in accordance with the provisions of the Act to include: the student's name, address, telephone listing, date and place of birth, major field of study, academic schedule, participation in officially recognized activities, dates of attendance, degrees and awards received, photo, university electronic mail address, and the most recent

previous educational agency or institution attended by the student. Students wanting directory information withheld should notify the University Registrar in writing within ten calendar days after the first scheduled day of class of the academic year of such election.

4. The right to file a complaint with the U.S. Department of Education concerning alleged failures by Thomas Jefferson University to comply with the requirements of FERPA. The name and address of the Office that administers FERPA is:

Family Policy Compliance Office
U.S. Department of Education
400 Maryland Avenue, S.W.
Washington, DC 20202-4605

Revisions and clarifications will be published as experience with the law and University policy warrant.

III. Policy and Procedures for Responding to Alleged Misconduct in Research

POLICY

Thomas Jefferson University (TJU) is committed to maintaining the integrity of scholarship and investigative research and to fostering a climate conductive to such scientific integrity. TJU expects the faculty and employees to maintain appropriate standards in the conduct of academic work, including teaching, patient care and research activities. Unethical research practices are a breach of contract between the faculty, students, employees, or staff members involved and the University. The University expects its faculty members to be responsible for the integrity of research carried out both under their supervision and within their research groups, no matter who performs the research. This policy applies to all employees and students of Thomas Jefferson University, particularly those individuals involved with research projects supported by the Public Health Service (PHS) or projects for which an application has been submitted.

If proven, misconduct in research may lead to a range of sanctions from minor to severe including but not limited to termination of appointment in the case of faculty, employment in the case of employees or dismissal in the case of students pursuant to the Bylaws and/or applicable personnel policies and procedures of the University.

OBJECTIVES

The objectives of this statement are to define what constitutes misconduct in research to establish procedures through which the University can evaluate and respond to allegations of such misconduct. This document will be distributed to all faculty and through them, to the research support staff and students, either separately or as part of the appropriate faculty, employee, or student handbook. Faculty, students and staff who observe misconduct are expected to report such misconduct through the procedures described below.

DEFINITION OF MISCONDUCT IN RESEARCH

No list of unethical research practices can be all-inclusive. Fundamentally, the definition of misconduct in research includes those activities that violate ethical standards of scholarship as established by the academic community. For these purposes, "misconduct" is defined as plagiarism; the fabrication or intentional falsification of data, research procedures or data analysis; or, other deliberate misrepresentations in proposing, conducting, reporting or reviewing research. Honest errors or honest difference in interpretation or judgment of date are not considered to be misconduct in research. Activities constituting misconduct in research include, but are not limited to, the following:

A. **Falsification of data -** Dishonest reporting of results including the intentional fabrication of data, improper manipulation or correcting of data, and intentional negligent practices in collecting, recording, storing or analyzing data. The ownership of all research data is vested with the University and the requirement for the maintenance of this data is vested in the principal investigators and their department chairmen. Faculty is expected to keep thorough records of their research activity and to ensure that the original or an exact copy of these records is preserved for use in the laboratory.

B. **Plagiarism -** Taking credit for others' work, ideas, results or methods; copying the writing of others without acknowledgment; or otherwise taking credit falsely.

C. **Abuse of confidentiality -** Using or releasing the ideas or data of others which were shared with the legitimate and appropriate expectation of confidentiality; for example, misappropriating ideas from submitted grant applications or manuscripts under review for publication while serving as a reviewer or member of an editorial or review board.

D. **Dishonesty in presentation and publication -** Utilizing material or publishing articles or date that will mislead listeners or readers; for example, misrepresenting data as to its originality, ownership or adding the names of other authors without their permission and approval. It is anticipated that the faculty will maintain appropriate standards in assuring that each individual included as an author has made a significant contribution to the conduct of the research and is aware of the contents of any scientific paper, grant application, abstract, or presentation bearing their name.

E. **Other violations -** Stealing, destroying, or deliberately damaging the research property of others such as research papers, records, supplies, equipment or products, maliciously accusing others of misconduct or knowingly failing to report misconduct.

PROCEDURES FOR CONDUCTING INQUIRIES INTO ALLEGED MISCONDUCT IN RESEARCH

The Committee on Research is the faculty committee charged with conducting inquiries into alleged misconduct in research. The procedure recognizes the need to protect the reputation of all individuals, not only those who have been alleged to have engaged in misconduct (the respondents), but also those who report such misconduct (the complainants). The committee will attempt to

resolve allegations of misconduct rapidly and in a fair and objective manner. Throughout the inquiry, the University will take appropriate interim administrative actions to protect Federal funds and ensure that the purposes of Federal financial assistance are being carried out.

If the Associate Dean of Scientific Affairs or the Chairman of the Committee on Research is either the complainant or respondent or in any other way has a conflict of interest or the appearance of a conflict of interest, they are obligated to remove themselves from the inquiry and/or investigation. In such cases, their role will be replaced by the Associate Dean of Administration and the senior faculty member of the Committee on Research, respectively.

A. Allegation - Before instituting a written allegation of misconduct, individuals are encouraged to review the matter, if possible, with their immediate supervisor, faculty member, department chairman or the Associate Dean of Scientific Affairs (the Associate Dean), as appropriate. A formal allegation of misconduct in research involving any faculty, employee, student, or staff member of the University must be communicated in writing by the complainant to the Associate Dean. The complainant should contain such detail or documentation as is deemed necessary to substantiate the need for an inquiry.

B. Inquiry Committee - Upon receipt of a complaint, the Associate Dean, in conjunction with the chairman of the Committee on Research, will appoint an Inquiry Committee consisting of no less than three individuals: two members of the Committee on Research and at least one member of the faculty with competence in the relevant scientific area. The Inquiry Committee will be chaired by the chairman of the Committee on Research and provided staff support by the Associate Dean. If possible, none of the members of the Inquiry Committee shall be from the same department or work as collaborators with either the complainant or the respondent. On appointment of the Inquiry Committee, the Associate Dean will notify, in writing, the respondent and his department chairman of the nature of the allegation and both the complainant and the respondent of the committee's composition. The Associate Dean, in conjunction with the respondent's department chairman, shall take whatever action he or she deems appropriate to protect the integrity of research data. These initial steps in the inquiry process will normally be completed within one week of receipt of an allegation.

C. Confidentiality - In general, confidentiality shall be maintained throughout the inquiry. Only those persons with a need to know shall be told of the allegation or information about the inquiry. Any person making an allegation shall remain anonymous throughout the initial inquiry process to all but the Inquiry Committee. However, the Associate Dean may determine that the need for confidentiality is outweighed by such factors as the potential for significant risks to the health and safety of individuals, the security of the research data or other overriding concerns in dealing with granting agencies. In particular, the Office of Research Integrity (ORI), Public Health Service must be notified if there are immediate health hazards or a need to protect Federal funds, equipment, or individuals affected by the inquiry. In

such cases, the need to disclose specific information and the possibility of public reporting will be discussed in advance, if possible, with all of the pertinent parties. If reasonable indication of possible criminal violations is found, the Office of Research Integrity must be notified within 24 hours.

D. Nature of the inquiry - The sole purpose of the Inquiry Committee shall be to gather information and determine whether the allegation warrants an investigation. The Inquiry Committee shall be empowered to review all records and to discuss the charges with the complainant, the respondent and with any other individual. When appearing before the Inquiry Committee, the respondent, complainant, or any other party may be accompanied by an advisor who may be an attorney, but who may not participate in the proceedings. Nothing herein shall be construed or interpreted as requiring the University to provide legal counsel to any party. Minutes of the meetings will be kept and will be available for review by all participants.

E. Report of the Inquiry Committee - The Inquiry Committee shall prepare a written report of its findings. The report shall state the evidence reviewed, summarize relevant information obtained, and the Committee's findings including the reasons for their conclusions. The final report of the Inquiry Committee should be submitted to the Associate Dean. A copy of the final report will be sent either by Federal Express or certified mail to both the respondent and the complainant within seven (7) days of receipt by the Associate Dean. The entire inquiry process shall normally be completed with sixty (60) days of the receipt of the allegation. In those circumstances where a delay is warranted, documentation of the reasons for such delay shall be maintained in the inquiry file in the Office of Research Administration.

F. Outcome of the Inquiry - The Inquiry Committee's written report shall recommend one of three possible actions to the Associate Dean:

1. *Dismissal of the Allegation:* The allegation of misconduct in research that is the subject of the inquiry is false and/or frivolous. When recommending dismissal of the complaint, the Inquiry Committee must provide justification of this conclusion in its written report so as to preclude a premature end to the investigation. In the event a decision is made to dismiss the claim, individuals involved in the inquiry shall use all diligent efforts to restore the reputation of the respondent, to protect his/her position and to protect the reputation of the complainant, if it is determined that the complaint was made in good faith.

2. *Administrative Action:* The allegation of misconduct in research which is the subject of the inquiry is trivial and is best dealt with by administrative actions. If the Inquiry Committee recommends that the matter be dealt with administratively, the Associate Dean will consult with the appropriate department chairman who will determine what administrative remedies are available and implement them as necessary.

3. *An Investigation is Required:* A more detailed investigation of the allegation that is the subject of the inquiry is warranted. If the Inquiry Committee concludes that a more thorough investigation is required, it shall recommend such an investigation to the Associate Dean who, subject to the appeal provisions described below, shall report its recommendation to the Senior Vice President for Academic Affairs.

   If the Inquiry Committee deems that administrative action is necessary or finds for dismissal of the allegations, TJU must maintain detailed documentation that an investigation is not warranted for at least three years and provide said documentation to authorized Health and Human Services personnel upon request.

G. Records - If the University and/or the Inquiry Committee plan to terminate an inquiry for any reason prior to completion, a report of the termination, including a description of the reasons for the termination, shall be made to the Office of Research Integrity.

H. Appeal - The complainant or respondent may appeal the findings of the Inquiry Committee by delivering to the Associate Dean a written statement of appeal (the appeal) not more than seven (7) days after the date on which the complainant and/or respondent shall have received the final report of the Inquiry Committee. The appeal shall set forth the reasons for which it is contended that the findings contained in the report of the Inquiry Committee should be overturned or invalidated. If either the complainant or respondent does not appeal with seven (7) days of receipt of the final report of the Inquiry Committee, he/she shall be deemed to have waived his/her rights to do so.

I. Scope of Appeal Review - The Associate Dean shall review and consider: 1. The complainants and/or respondents appeal, 2. The report of the Inquiry Committee, 3. The minutes of the Inquiry Committee meetings, 4. Any documentary evidence received by the Inquiry Committee in the course of that investigation, and 5. Any such other materials as the Associate Dean may deem appropriate.

J. Action on Appeal - Not more than seven (7) days after receipt of an appeal, or as soon thereafter as may be reasonably practicable, the Associate Dean shall decide the appeal. In considering and deciding any appeal, the Associate Dean shall be strictly limited to the application of the following standard of review; based upon a review of the materials listed above, a determination shall be made as to whether the findings set forth in the Inquiry Committee's report are substantially supported by the evidence in the record. In applying this standard of review, the Associate Dean shall not substitute his/her judgment as to the appropriate outcome of the inquiry for that of the Inquiry Committee.

K. Outcome of Appeal - If the Associate Dean determines that the findings set forth in the Inquiry Committee's report are substantially supported by the evidence in the record, then he/she shall promptly notify the complainant and the respondent that the appeal has been denied and that no further recourse with respect to the Inquiry or its outcome shall be available. If the Associate Dean determines that the findings set forth in the Inquiry Committee's report are not substantially supported by the evidence in the record, then he shall promptly notify the complainant and respondent accordingly and take such action with respect to the inquiry and its outcome as he deems necessary or appropriate. Such action may include, but shall not be limited to, reopening the inquiry either through the Inquiry Committee or by the formation of a new committee if the Inquiry Committee recommendation is to dismiss or take administrative actions. If the finding of the Inquiry Committee is that an investigation is warranted, he must immediately notify the Dean and Senior Vice President for Academic Affairs.

PROCEDURES FOR CONDUCTING AN INVESTIGATION OF POSSIBLE MISCONDUCT IN RESEARCH

If the Inquiry Committee finds that a formal investigation is warranted, the Associate Dean of Scientific Affairs shall notify the complainant and the respondent and identify the complainant to the respondent. The Associate Dean of Scientific Affairs shall notify any funding agency as required. In consultation with the Senior Vice President for Academic Affairs and Dean (the Dean) and the Associate Dean for Scientific Affairs, the department chairman involved will take appropriate steps to safeguard the affected research.

Throughout the Investigation, the University will take appropriate interim administrative actions to protect Federal funds and ensure that the purposes of Federal financial assistance are being carried out.

In general, confidentiality shall be maintained throughout the investigation process. Only those persons with a need to know shall be told of the allegation or information about the investigation. Any person making an allegation shall remain anonymous throughout the investigation process to all but the Investigation Committee. However, the Associate Dean may determine that the need for confidentiality is outweighed by such factors as the potential for significant risks to the health and safety of individuals, the security of the research data or other overriding concerns in dealing with granting agencies. In particular, the Office of Research Integrity must be notified if there are immediate health hazards or a need to protect Federal funds, equipment, or individuals affected by the inquiry. In such cases, the need to disclose specific information and the possibility of public reporting will be discussed in advance, if possible, with all of the pertinent parties. If reasonable indication of possible criminal violations is found, the Office of Research Integrity must be notified within 24 hours.

A. Ad Hoc Investigation Committee - Within thirty (30) days of receiving a recommendation for a formal investigation (the Investigation) of alleged misconduct in research, the Dean shall appoint an Ad Hoc Investigation Committee (the Committee) of no less than three members to conduct a prompt and thorough investigation of the alleged misconduct. The membership of the Committee shall consist of: at least two senior faculty members who have sufficient scientific expertise to analyze the specific research issues and publications (if any) involved, at least one scientist in this same area from outside the University, and other members as appropriate. The Dean shall appoint one of the members as Chairman. If possible, none of the members of the Committee shall have any personal responsibility for, or involvement in, the research under investigation nor have served on the Inquiry Committee. The Committee shall be staffed by the office of the Associate Dean of Scientific Affairs and shall be advised by representatives of the Office of University Counsel.

B. Notification - The respondent shall receive: 1) written notice of the specific allegations, and 2) a copy of the Policy and Procedures for Responding to Alleged Misconduct in Research. In addition, the following parties shall be notified in writing that an investigation is being undertaken: 1. The complainant(s), 2. All identifiable collaborators on the research in question or supervisors of the research, 3. The principal investigator for the research, 4. The affected department chairman, 5. The Office of University Counsel, 6. The Office of the President, 7. The granting agency, if appropriate, 8. The chairs of any appropriate committees (e.g. Committee on Research, Institutional Animal Care and Use Committee, the Institutional Review Board and others as shall be determined by the Associate Dean of Scientific Affairs), 9. The Office of Research Integrity.

   These individuals will also be informed of the composition of the Committee. Where appropriate, one or more of these committees or the Associate Dean of Scientific Affairs may take additional steps to protect the human or animal research subjects or research data during the Investigation. All those informed will be reminded of the need to maintain confidentiality during the Investigation.

C. Investigation - The Committee shall undertake a thorough examination of the charges, including a review of all relevant primary research data, proposals, publications, correspondence and any other information available to make a thorough review of the allegation. If necessary, interviews shall be conducted with the complainant, the respondent, as well as others who may have information regarding the alleged misconduct. Written summaries of all interviews shall be included as part of the investigatory file. If, during the course of the Investigation, it appears warranted, consideration may be given to the review of any related research in which the respondent is involved. Following completion of the Investigation, the Committee shall submit a written report with full documentation to the Dean. This report shall describe the procedures under which the Investigation was conducted, how, and from whom information was obtained, summaries of interviews, a summary of the findings of the Committee and recommendations for actions if misconduct in research is determined to have occurred.

If the University and/or the Ad Hoc Investigation Committee plans to terminate an investigation for any reason prior to completion, a report of such planned termination, including a description of the reasons for such termination, shall be sent to the Office of Research Integrity.

If, during the course of the Investigation, facts are disclosed that may affect current or potential Department of Health and Human Services (DHHS) funding for an individual(s) under investigation or that PHS needs to know to ensure appropriate use of Federal funds and otherwise protect the public interest, ORI must be immediately notified.

D. Rights of Parties - The respondent and the complainant in the Investigation shall be accorded (but shall not be required to exercise) the following rights which, if exercised, must be exercised in a prompt and timely manner so as not to unreasonably delay the progress or completion of the Investigation:

1. Be present at all meetings or other proceedings of the Committee at which witnesses are interviewed,
2. Be furnished copies of summaries of all witness interviews conducted by the Committee,
3. Be furnished copies of all documentary evidence considered by the committee as part of its investigation promptly following the Committee's receipt of the same,
4. Retain one advisor of their choice (who may be an attorney) who may attend, but not participate, in any meetings or other proceedings of the Committee at which witnesses are interviewed,
5. Question witnesses, present evidence, statements, and/or arguments on their own behalf orally, in writing, or both to the Committee to rebut any of the other evidence received by the Committee and for any other purpose reasonably related to the issues involved in the investigation.

***Nothing herein shall be construed or interpreted as requiring the University to provide legal counsel to any party.*

E. Duration of Investigation - The Committee shall, if possible, complete its Investigation within 120 days from the date of the initiation of the Investigation. If it is determined that the Committee will not be able to complete the Investigation within 120 days, it shall submit to the Dean a written request for an extension and an explanation of the reason for the delay. In addition, if it is determined that the Committee will be unable to complete the Investigation within 120 days, it shall submit a request for an extension to the Office of Research Integrity and include an explanation for the delay, an interim report on the progress to date, an outline of the remaining work, and an estimated date of completion.

F. Documentation - The Committee will prepare and maintain documentation to substantiate the findings of the Investigation. This documentation is to be made available to the Director of the Office of Research Integrity.

G. Report of the Committee - Upon completion of the Investigation, the Committee will forward a written report to the Dean setting forth its findings and recommendations, if any. The Dean shall, in turn, forward copies of the

report to both the respondent and the complainant by Federal Express or certified mail within seven (7) days of its receipt. The Committee report will reach one of three possible conclusions:

1 No misconduct in research was demonstrated; or

2. No misconduct in research appeared to have been committed but problems were identified that require administrative remedies; or

3. Misconduct in research was determined to have occurred.

PROCEDURES FOR DISMISSAL IF RESEARCH MISCONDUCT WAS NOT FOUND

A. Dismissal of Allegations - If the Dean concurs with the Committee's findings that no misconduct has been committed by the respondent, all parties shall then be notified of the Committee's conclusions. In the event a decision is made to dismiss the allegation, individuals involved in the investigation shall use all diligent efforts to restore the reputation of the respondent, to protect his/her position and to protect the reputation of the complainant, if it was determined that the complaint was made in good faith. Such efforts may include the reimbursement of the reasonable expenses (including the reasonable cost of legal counsel) actually incurred by the respondent to defend himself/herself with respect to the misconduct in question during the course of the investigation. Such reimbursement shall be subject to a maximum limit established by the Dean at the onset of the investigation but subject to revision either upward or downward by the Dean as he may determine to be appropriate.

PROCEDURES FOR ADMINISTRATIVE REMEDIES RECOMMENDED BY THE COMMITTEE

A. Administrative Remedies - If the committee finds no evidence of misconduct in research but identifies problems that require administrative remedies, the Committee may recommend such action. If the Dean concurs with this recommendation, he will confer with the respondent and the department chairman involved to determine and implement the most appropriate administrative actions.

B. Appeal of Administrative Remedies and/or Sanctions - Administrative remedies, actions or sanctions imposed upon the respondent may be appealed through the Faculty Grievance Procedure of the Committee on Faculty Affairs in the case of faculty, or through approved University grievance procedures for employees and staff, or the judicial system of review in the case of students. No other appeal of the findings of the investigation other than that described above shall be permitted.

PROCEDURES IF RESEARCH MISCONDUCT WAS DETERMINED TO HAVE OCCURRED

A. Sanctions if Misconduct is Found - The Dean shall forward the findings of the Committee to the appropriate department chairman for imposition of sanctions. Sanctions for misconduct may include but are not limited to dis-

missal, suspension, probation or re-examination of faculty status which may include salary and/or rank reduction. If the respondent is a department chairman, the Dean shall determine the appropriate sanctions. If the individual is not a faculty member, the Dean and/or department chairman can recommend the imposition of sanctions as permitted under the personnel policies and procedures of the University.

B. Additional Actions if Misconduct is Found - If misconduct was determined to occur, the following actions may also take place, where applicable, as may be recommended by the committee and/or the Dean and department chairman or as required by law:

   1. The agency providing grants for the research in question will be notified of the findings of the investigation and sanctions imposed; and/or

   2. Institutions and granting agencies with whom a respondent has previously been affiliated will be notified if there is reason to believe that previous research may be questionable; and/or

   3. All appropriate state or federal agencies that require notification of scientific misconduct will receive written notice of any disciplinary actions; and/or

   4. Any pending abstract and papers affected by the research practices which have been found to be unethical or fraudulent are to be withdrawn by the author(s). The editors of journals which have published abstracts and papers that are in doubt will be notified in writing; and/or

   5. The state licensing boards will be notified, if applicable; and/or

   6. A record of the Committee's report and sanctions imposed shall be placed in the individual's faculty record.

C. Protection of Complainant - Any complainant will be protected from real or apparent reprisals regardless of whether or not the respondent is exonerated of charges of misconduct if it was determined that the complaint was made in good faith. The University shall indemnify and defend any of its faculty members, employees or students who bring forward an allegation of misconduct or who provide information including professional or personal judgments during the course of an inquiry or investigation of misconduct provided such allegations are made or information provided in good faith and within the scope of employment or educational experience.

APPEAL PROCESS FOR FINDINGS OF MISCONDUCT

Faculty:

A. The Inquiry and Investigation per this policy will supersede Section 10, Termination of Appointment, D 1-7, Dismissal for Cause, of the By-laws of the Jefferson Medical College of Thomas Jefferson University. Upon notification of sanctions imposed, faculty members will have the right of appeal per Section 10, 7-c, of the By-laws.

B. Appeal of the Findings of the Investigation Committee - If the respondent wants to appeal the findings of the Investigation Committee, he/she must do so in writing within fifteen days to the President of the Executive Council.

C. Scope of Appeal - The President may:

1. limit his review to only the report of the Ad Hoc Investigation Committee, or

2. expand his review at his discretion to other documents or to personal interviews.

D. Action on Appeal - In considering and deciding an appeal, the President shall be strictly limited to the application of the following standard of review: Based upon a review of the materials listed in Section M, a determination shall be made as to whether the findings set forth in the Committee's report are substantially supported by the evidence in the record. In applying this standard of review, the President shall not substitute his judgment as to the appropriate outcome of the investigation for that of the Committee.

E. Outcome of the Appeal - If the President determines that the findings set forth in the Committee's report are substantially supported by the evidence in the record, then he shall promptly notify the respondent and the complainant that the appeal has been denied and that no further recourse with respect to the investigation or its outcome shall be available. If the President determines that the findings set forth in the Committee's report are not substantially supported by the evidence in the record, then he shall promptly notify the respondent and the complainant accordingly and take such action with respect to the investigation and its outcome as he deems necessary or appropriate. Such action will be final and binding and may include, but shall not be limited to (a) determining that the investigation should be reopened and pursued further in certain respects, which the President may specify, either by the Committee or by a new investigating committee which the Dean shall appoint and which shall proceed in accordance with this policy, or (b) determining that the possible misconduct in research which is the subject of the investigation cannot be proven and taking such actions as he may deem appropriate.

The decision of the President of the Executive Council shall be final and binding. If the sanction imposed is dismissal, the Dean shall determine when the termination shall be effective.

Non-Faculty:

A. Appeal of the Findings of the Investigation - The respondent or the complainant may appeal the findings of the Committee by notifying the Dean in writing of his/her intention to do so not more than seven (7) days after the date (the notification) on which the respondent or complainant shall have received the final report of the Committee as defined above. The respondent or complainant shall deliver to the Dean within thirty (30) days of notification, a written statement (the statement) setting forth, in such manner and detail as seems appropriate, the reasons for which he/she contends that the findings contained in the report of the Committee should be overturned and/or invalidated. Failure to provide the statement within thirty days of notification shall be deemed as a waiver of any right to appeal.

B. Scope of Appeal Review - The Dean may:

1. limit his review to only the report of the Ad Hoc Investigation Committee, or

2. expand his review at his discretion to other materials or interviews he may deem appropriate.

C. Action on Appeal - Not more than sixty (60) days after notification, or as soon thereafter as may be reasonably practicable, the Dean shall decide the appeal. In considering and deciding an appeal, the Dean shall be strictly limited to the application of the following standard of review; based upon a review of the materials listed in Section M, a determination shall be made as to whether the findings set forth in the Committee's report are substantially supported by the evidence in the record. In applying this standard of review, the Dean shall not substitute his judgment as to the appropriate outcome of the investigation for that of the Committee.

D. Outcome of Appeal - If the Dean determines that the findings set forth in the Committee's report are substantially supported by the evidence in the record, then he shall promptly notify the respondent and the complainant that the appeal has been denied and that no further recourse with respect to the investigation or its outcome shall be available. If the Dean determines that the findings set forth in the Committee's report are not substantially supported by the evidence in the record, then he shall promptly notify the respondent and the complainant accordingly and take such action with respect to the investigation and its outcome as he deems necessary or appropriate. Such action will be final and binding and may include, but shall not be limited to (a) determining that the investigation should be reopened and pursued further in certain respects, which the Dean may specify, either by the Committee or by a new investigating committee which the Dean shall appoint and which shall proceed in accordance with this policy, or (b) determining that the possible misconduct in research which is the subject of the investigation cannot be proven and taking such actions as he may deem appropriate.

INTERPRETATION OF THIS POLICY AS CONSISTENT WITH APPLICABLE FEDERAL REGULATIONS

This policy is intended to conform to the requirements of 42 CFR, Part 50, Subpart A, as promulgated on March 22, 1989 and published in the Federal Register, Volume 54, Number 151, on August 8, 1989 (the "PHS Regulations") as may be amended. Whenever any provision of this policy may be interpreted or applied in more than one way, that interpretation or application which clearly is in accord with the PHS regulation shall prevail.

(revised 1/98)

IV. Use of the Name of the College of Graduate Studies

No student organization or individual student may enter into any contractual agreement using the name of the organization or of the College of Graduate Studies without prior approval by the Dean of the College.

V. Sexual Harassment Policy

I. Statement of Purpose

Thomas Jefferson University is committed to providing a learning, working, and clinical environment which respects the dignity of all individuals in the University community. Accordingly, sexual harassment in any form or context will not be tolerated. This policy defines the University's position on this vital subject and provides guidelines for all members of the Jefferson community to ensure the University remains free from sexual harassment.

II. Scope

This policy applies to all employees, faculty and students of Thomas Jefferson University.

III. Definition of Sexual Harassment

Sexual harassment is defined as unwelcome sexual advances, emphasis of sexual identity, or requests for sexual favors, and other verbal or physical conduct of a sexual nature when:

1. Submission to such conduct is made either explicitly or implicitly a term or condition of an individual's employment or academic performance.
2. Submission to or rejection of such conduct by an individual is used as a factor in employment or academic decisions affecting an individual.
3. Such conduct has the purpose or effect of substantially interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment.

The definition of sexual harassment will be interpreted and applied consistent with accepted standards of mature behavior, academic freedom, and freedom of expression.

IV. Prohibited Conduct

1. It shall be a violation of University policy for anyone:
   a. To make sexual advances or request sexual favors as the basis for either implicitly or explicitly recommending, granting, or refusing terms and conditions that affect the status of the employee, job applicant, or student.

b. To recommend, grant, or refuse to take any official action consistent with his or her duties and responsibilities because of sexual favors, or as a reprisal against an employee, job applicant, or student who has rejected or reported sexual advances.

c. To engage in conduct having the purpose or effect of substantially interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment.

d. To disregard or fail to investigate allegations of sexual harassment, whether reported by the subject or by a witness, and to fail to take immediate corrective action in the event misconduct has occurred.

2. Persons who are not employed by or directly affiliated with the University, including but not limited to vendors, contractors, and salespersons, shall be subject to the above prohibitions in their conduct involving members of the University community.

V. Resources for Assistance

It is recognized that informal procedures such as discussion and counseling can be effective in attaining prompt and constructive resolution of sexual harassment concerns. Resources available for advice and assistance include but are not limited to the following:

— Office of Employee Relations, 237 Martin, 503-7758.

— University Affirmative Action Officer, 157 Jefferson Alumni Hall, 955-6988.

— Office of Student Affairs, Jefferson Medical College, 157 Jefferson Alumni Hall, 955-6988.

— Office of Student Affairs and Services, College of Allied Health Sciences, 708 Edison, 503-8189.

— Office of the Dean, College of Graduate Studies, M-63 Jefferson Alumni Hall, 503-8986.

VI. Complaint Resolution Procedure

1. Aggrieved persons are encouraged, if possible, to directly inform the person engaging in sexually harassing conduct or communication that such conduct or communication is offensive and must stop.

2. Aggrieved persons who do not wish to communicate directly with the person whose conduct or communication is offensive, or who have found no remedy through direct communication with the offending party, should contact any of the resources listed in Section V above for guidance and assistance.

3. When informal means of resolution are not chosen or prove unsatisfactory, any person who believes that he or she is a victim of sexual harassment may file a complaint as follows:

— Employees - his or her supervisor or the supervisor of the person who is behaving objectionably, or the Office of Employee Relations.

— Faculty - the appropriate Department Chair, Dean, or University Affirmative Action Officer.

— Students - the appropriate faculty member, Department Chair, or Office of Student Affairs.

4. In addition to the complaint procedure outlined in Section VI (3) above, aggrieved persons alleging either sexual harassment by anyone with supervisory or academic authority, or failure by an appropriate supervisor to take immediate action on the individual's complaint about an employee or non-employee, may file a formal grievance in accordance with the provisions of the appropriate University EEO Grievance Procedure, which is filed in the Department of Human Resources. The aggrieved person will be required to submit a written statement documenting the specific nature of the change and the identity of the accused person.

5. All complaints and concerns about conduct of vendors, contractors, and salespersons shall be addressed to the Office of Employee Relations which will then review the matter in conjunction with the Department serving as the liaison with the subject vendor, contractor, or salesperson.

6. All complaints of sexual harassment will be investigated promptly, equitably, and, to the extent practicable, confidentially. In order to ensure consistent application of this policy, the Office of Employee Relations will either conduct the appropriate investigation or serve as a consultative resource to the individual conducting the investigation.

VII. Discipline

The violation of this policy by any member of the University community will result in disciplinary action up to and including dismissal. Threats, intimidation or retaliation against any member of the University community who brings forth a complaint in good faith, either formally or informally, is strictly prohibited and may, in and of itself, be the basis for disciplinary action.

VIII. Confidentially

All reasonable efforts will be made to ensure the confidentially of information received, and protect the privacy rights of all parties.

IX. Training

Educational efforts are an essential component of the University's efforts to establish a community free from sexual harassment. The Office of Employee Relations is responsible for presenting educational and training sessions about sexual harassment to ensure that all members of the University community are aware of sexual harassment in all forms.

VI. Sexual Offense Response Policy

Definitions

In accordance with its goal of providing a secure community for its students, Thomas Jefferson University has developed this sexual offense response policy for the student population. For the purpose of this policy, sexual offenses include, but are not limited to, rape, statutory rape, involuntary deviate sexual intercourse, indecent exposure, indecent assault, and aggravated indecent sexual assault. A forcible sex offense may be directed against another person against his or her will or against a person who is incapable of giving consent because of minority or incapacity.

A sexual offense is a criminal act which may subject the perpetrator to campus disciplinary action in accordance with established procedures and/or criminal and civil penalties under state and federal laws.

Educational Programs

Educational programs are provided by Thomas Jefferson University's Department of Security, the Colleges' Offices of Student Affairs, the Residence Life Office of the Department of Housing and Residence Life, and by some student organizations. They are advertised widely on campus. The programs are designed to promote awareness of rape and other sexual offenses.

Sanctions

Following a finding of guilt in an on-campus disciplinary procedure, sanctions could include, but are not limited to, suspension or expulsion from Thomas Jefferson University in accordance with the policies set forth in the statement of Student Rights, Freedoms, and Responsibilities. The accused individual may also be prosecuted under Pennsylvania civil and criminal statues by the appropriate civil procedures and criminal authorities.

Procedures

A. When a report of sexual assault is made to University authorities on an emergency basis, the Security Department or other University personnel will escort the person reporting the crime ("the complainant") to a place of safety and will identify, secure, and maintain the scene of the alleged assault or offense, as appropriate, in accordance with departmental guidelines. The complainant will be informed of the availability of immediate medical and/or psychological assistance at the TJUH Crisis Center and, if desired, Security personnel or other University staff will escort the person there. At that time, Security will also inform the complainant of the need to preserve evidence, if any, should he or she choose to pursue other legal avenues.

B. In all circumstances, the complainant shall be apprised of his or her rights and, with his or her permission, the following steps shall occur in the case of a reported sexual offense of assault:

1. *Notification:* The designated Student Affairs Officer in the appropriate College and the Director of the University Office of Student Affairs shall be notified in order to maintain coordination of campus services.
2. *Filing Charges:* The complainant will be informed of the procedures for filing charges through the College disciplinary procedures and for filing criminal charges via the Sex Crimes Unit of the Philadelphia Police Department.
3. *Support Services:* The Director of the University Office of Student Affairs will provide information regarding campus/community services available to the complainant for immediate and ongoing support. These services include, but are not limited to, counseling through the University Health Service and referral to such community organizations such as Women Organized Against Rape. As appropriate, the Director will confirm with the complainant that the services sought on campus were provided.

Disciplinary Procedures

Campus disciplinary procedures are detailed in the Statement of Student Rights, Freedoms, and Responsibilities under the heading of "Judicial System" in the College catalogs and/or student handbooks. If the complainant chooses to follow the campus judicial system, both the complainant and the accused shall be informed of the outcome of any Judicial Board deliberations.

Student Alcohol Policy

Thomas Jefferson University does not endorse the use of alcohol at student functions. However, student organizations may decide that it is appropriate to serve alcohol after carefully considering all circumstances. Any organization or group of students that sponsors an event where alcohol is served is expected to conform to this Policy, as well as to the procedures stated in the Commons regulations and the Housing Office's rules.

The laws of the Commonwealth of Pennsylvania regulate the sale, service, possession and consumption of alcoholic beverages on Jefferson's campus. All members of the University community are responsible for knowing, understanding and obeying these laws, regulations and ordinances. The University does not have the authority to alter the laws or to secure exemption from them.

In accordance with Pennsylvania law, no individual under 21 years of age may possess or consume alcoholic beverages in or on University property. Persons 21 years of age or older may possess and consume alcohol only within the privacy of their on-campus residences or in common areas as specified below. The University neither condones nor shields from prosecution the actions of those individuals who serve alcohol to persons under the legal age in violation of Pennsylvania law.

The use of alcoholic beverages at social functions for students at Jefferson is restricted to those functions open to members of sponsoring organizations or groups and their invited guests, where the service of alcohol is restricted to areas designated by the appropriate authority, as defined below. In all cases, state laws governing the dispensing of alcoholic beverages must be observed.

Authority to Use Alcohol

No alcohol is to be consumed by any student in any common campus area without permission to do so from the appropriate authority. **Alcohol may not be served at outdoor locations on campus.** Exceptions may be made only by the Office of the President. Students seeking to hold a function where alcohol is to be served must obtain written authorization to do so not less than five days in advance of the function, as follows:

a. for those events under the supervision of the Activities Office, approval must be obtained from the Director of the Activities Office;

b. for the University's Housing facilities, approval must be obtained from the Department of Housing and Residence Life by completing the Community Lounge Reservation Request Form; and

c. if an organization or group of students desires to serve alcohol at a function held in an area other than those specified above, approval must be obtained from the Office of Student Affairs in the college with which the organization or group is associated.

d. A representative of the authorizing office must be present or on call at the event.

The organization or group must designate one person over the legal age who will be the sponsor for the function. That individual shall be personally responsible for compliance with all applicable rules and regulations.

Disciplinary Action

Any student who violates this Policy will be subject to disciplinary action as outlined in the individual college's catalogs and student handbooks, or in the Residential Intervention Policy, as appropriate.

VIOLATION OF THIS POLICY MAY RESULT IN SUSPENSION OR DISMISSAL FROM THE UNIVERSITY.

Procedures

If the appropriate authority permits the consumption of alcohol at any student function at Thomas Jefferson University, then the following procedures, as well as any additional procedures required by the sponsoring organization or group, or the University, must be followed.

A. Promotional Literature

1. The University will not distribute, post or mail any student function's advertisements that mention alcohol.

2. The sponsoring organization or group will post a legible sign at the function stating that individuals under the age of 21 years or those who are visibly intoxicated will not be permitted to consume or possess alcoholic beverages. This poster will be placed in a clear and conspicuous location at all functions where alcohol is served. The poster will read as follows: No one under 21 years of age or who is visibly intoxicated will be served an alcoholic beverage. Any individual requesting alcohol must, prior to being served, show a photograph identification that includes the date of birth. Noncompliant individuals will be asked to leave the premises immediately. This may include anyone over 21 years of age serving alcohol to someone less than 21 years of age or visibly intoxicated.

B. Party Procedures

1. Only those beverages served by the sponsoring organization or group are allowed at the event.

2. Non-alcoholic beverages such as soda must be made available at no cost to anyone attending the event.

3. Alcohol will not be sold by the sponsoring organization or group.

4. The individual designated as sponsor will ensure that identification is provided at the point of service of alcohol [please refer to Promotional Literature, item #2].

5. No one under the age of 21 years will be permitted to serve alcohol.

6. The sponsoring organization or group will have full discretion to refuse to serve alcoholic beverages to anyone whose age is questionable or who is suspected of being "under the influence."

7. The sponsoring organization or group will provide sufficient food for all persons present.

8. The service of alcohol will be discontinued at least thirty minutes prior to the end of the event.

9. At any function where alcoholic beverages are served, at least one person will be formally designated by the sponsoring group to be responsible for ensuring adherence to these procedures.

C. Underage Student/Guest Participation

Students or guests under the age of 21 years may be allowed to participate at these functions pursuant to the following procedures:

1. Underage attendees will not consume or possess any alcoholic beverages anywhere within the University property; and

2. Any attendee who attempts to provide an alcoholic beverage to someone less than 21 years of age will be removed from the event and will face possible disciplinary action, including suspension or dismissal from the University.

D. Guest Responsibility

1. Jefferson students are responsible for their guests at all times.
2. If a guest violates this Policy or any other rule, or displays unruly/ inappropriate behavior, he or she will be asked to leave the event. In that instance, the Jefferson student who brought the "guest" may also face expulsion from the event and/or disciplinary action.

E. In the Event of an Incident

1. Security will be notified by the event's sponsor if there are problems related to the enforcement of this Policy.
2. An Incident Report will be filed for any alcohol-related incident. These reports will be sent to the student's college for review and possible disciplinary action. A copy of the report will also be sent to the University Office of Student Affairs.

F. Organizations

An organization or group sponsoring an event where alcohol will be served may not use the Jefferson name to imply either Jefferson's sponsorship or endorsement of alcohol at the event.

UNLAWFUL POSSESSION, USE OR DISTRIBUTION OF ILLICIT DRUGS OR ALCOHOL

Background

The Federal Government requires institutions of higher education to certify that they have adopted and implemented a program to prevent the unlawful possession, use or distribution of illicit drugs and alcohol by students and employees. The policies addressing both students and employees are contained in University policies number 102.22 Alcohol Sale and Use, 102.23 Drug Sale and Use, 102.28 Student Alcohol Policy, and 102.29 Drug and Alcohol Policy. To comply further with the act, the following information is being made available to all students and employees in the University.

STANDARDS OF CONDUCT

Alcoholic Beverages

Pennsylvania law forbids a person less than twenty-one years of age to attempt to purchase, consume, possess or transport any alcoholic or malt or brewed beverage within the Commonwealth. Violation of this law could result in disciplinary action including suspension or dismissal from the University.

Thomas Jefferson University policy 102.28 addresses the University's position regarding possession and use of alcoholic beverages by students. Policy 102.29 includes a statement on possession and use of alcoholic beverages by employees.

Drugs

The laws of the Commonwealth of Pennsylvania and of the United States prohibit the use, possession, sale and traffic in marijuana and illicit drugs. The University will not shield any student or employee from actions of civil authorities arising from any unlawful acts committed by the student or employee. The University complies with the civil laws concerning drugs.

The willful possession, merchandising or consumption of drugs, other than for medicinal purposes, may result in suspension or dismissal from the University. The University reserves the right to investigate any student's housing facility or belongings if it has information which would lead to a reasonable belief that any illegal or illicit activity is taking place.

Legal Sanctions for the Unlawful Possession or Distribution of Illicit Drugs and Alcohol

In addition to University sanctions, the University complies with all state and federal drug and alcohol control laws. State and federal sanctions include both fines and imprisonment. A summary of state and federal criminal sanctions is available in the University Office of Student Affairs, 708 Edison.

Health Risks of Alcohol and Drug Abuse

The health risks of alcohol and drug abuse are serious and extensive. Detailed information is available in the University Office of Student Affairs.

Drug or Alcohol Counseling, Treatment and Rehabilitation

Students in need of counseling, treatment or rehabilitation services should contact the University Health Service for initial screening, treatment and referral. The University does not provide free drug or alcohol rehabilitation programs. Students are referred to appropriate hospital or community agencies for these services.

Employees should contact either the University Health Service or Jefferson Advantage, a confidential referral organization retained by the University.

Disciplinary Sanctions

It is expected that students and employees of Thomas Jefferson University will comply with all Thomas Jefferson University policies and the laws regulating alcohol and illicit drugs. Those students who fail to comply will be subject to disciplinary action as published in the Statement of Student Rights, Freedoms and Responsibilities. Employees who fail to comply will be subject to disciplinary action as published in the Thomas Jefferson University Policy Manual. These disciplinary sanctions may include suspension or dismissal from the University and/ or the completion of an appropriate rehabilitation program.

This information is furnished in compliance with the Drug-Free Schools and Communities Act Amendments of 1989, Public Law 101-226.

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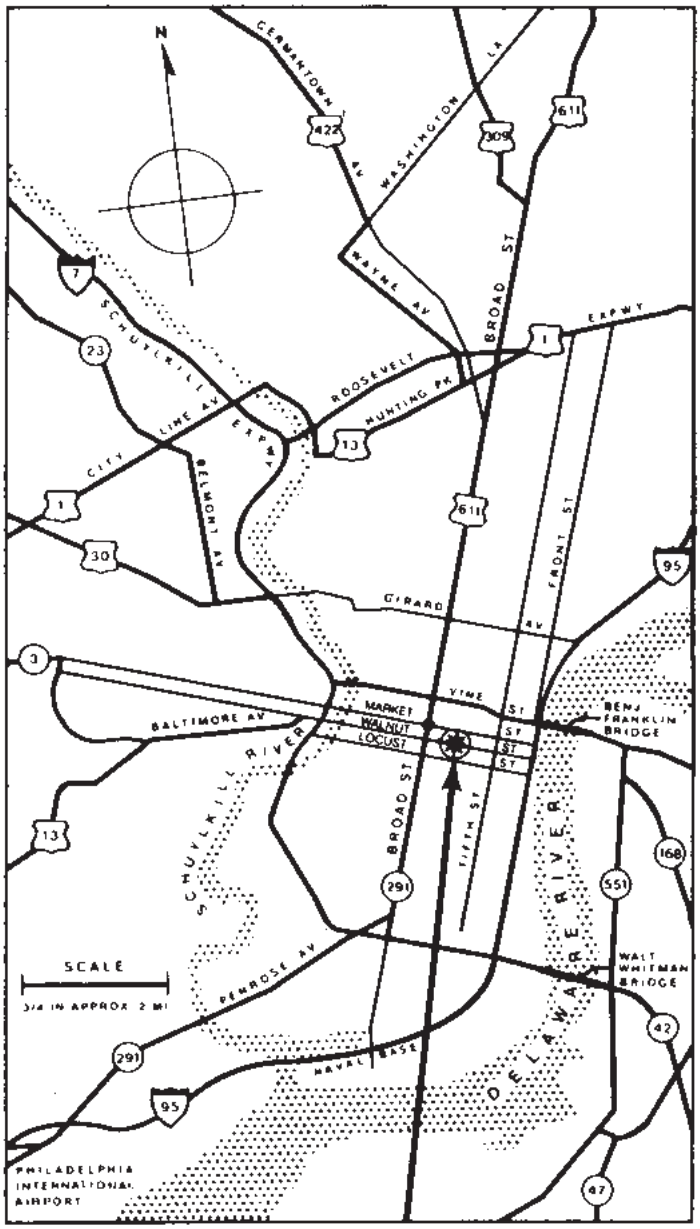

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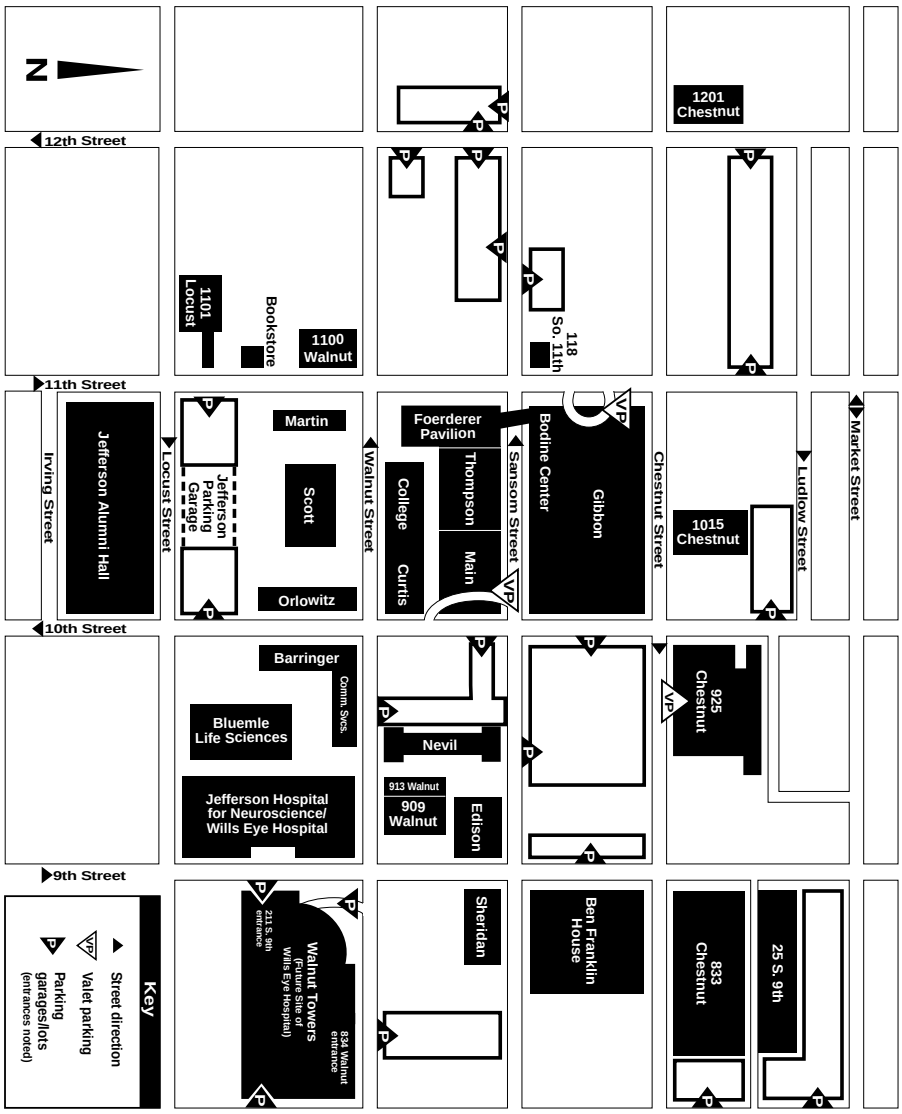
Campus Map

Thomas Jefferson University



Campus Map Key:

The Jefferson campus occupies approximately 13 acres in Center City, bounded by Chestnut Street to the north, Irving Street to the south, 9th Street to the east, and 11th Street to the west.

Gibbon Building: Patient rooms and services, physician offices, security, commercial space, cafeteria

Bodine Center for Cancer Treatment: Radiation therapy

Foerderer Pavilion: Patient rooms and services

Thompson: Patient rooms and services, DePalma Auditorium

Main: Patient services

College: Jefferson Medical College administration and classrooms, clinical science departments, Herbut Auditorium, McClellan Hall

Curtis: JMC classrooms, clinical science departments, patient services

1100 Walnut: Same day surgical center and physician offices

Martin: Student residence, human resources, outpatient billing

Scott: Library, University administration, Corporate Services

Orlowitz: Student residence

Barringer: Student residence, day care center, commercial space

Parking Garage: 400 parking spaces

Bluemle Life Sciences Building: Departments of Biochemistry & Molecular Biology, Dermatology, Microbiology & Immunology, Pharmacology, and Department of Medicine's research division of rheumatology; the Stein Center and Kimmel Cancer Center

Jefferson Alumni Hall: College of Graduate Studies administration; Jefferson Medical College Office of Student Affairs; Departments of Anatomy and Developmental Biology, Microbiology and Immunology, Pathology and Cell Biology, Pharmacology; research laboratories of Department of Medicine; recreation facilities; food court; Solis-Cohen Auditorium; Mezzanine Auditorium

Edison: College of Health Professions administration, department offices and classrooms, Corporate Services departments

1015 Chestnut Street (Jefferson Building): Marketing and public relations; hospital administrative departments (leased facility)

909 Walnut: Outpatient, MRI, and physician offices

Walnut Towers: Outpatient dialysis and physician offices (leased facility)

The Ben Franklin House: Development, physician offices (leased facility)

118 So. 11th Street: Administrative offices

Sheridan and Nevil: Administrative offices